Sedona Highway Corridor Assessment

Technical Memorandum #1 — Identification and Analysis of Existing and Future Conditions

Technical Memorandum #2 — Initial Concept Screening

Technical Memorandum #3 — Alternative Evaluation

Technical Memorandum #4 — Assesment of Proposed Corridor Improvements

Technical Memorandum #5 — Implementation Plan fo Circulation System Improvements

Prepared for

The City of Sedona

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December 1996

Executive Summary

This Sedona Highway Corridor Assessment is a compilation of five technical memorandums which address problem areas and improvement options to SR 89A and SR 179 corridors in Sedona. It constitutes a technical assessment & update of previous studies including Sedona Area Transportation Study (PBQD, 1991), the Uptown/Creek Area Study, the West Sedona Commercial Corridor Study & incorporates the information resulting from the Sedona Traffic Model and Origin-Destination Study (CH2M HILL, 1996). As a result of these studies & this assessment, specific problem areas have been identified, and the corridors have been divided into four distinct sections: West Sedona, the Y-intersection, SR 179, and the Uptown business area.

CH2M HILL was tasked to evaluate improvement options to enhance the traffic capacity and efficiency along the two corridors. The work consisted of five tasks, each resulting in the preparation of a technical memorandum.

Technical Memorandum #1 - Identification / Analysis of Existing and Future Conditions

In order to properly evaluate specific alternative solutions along the two highway corridors, the Sedona Traffic Model was updated (and re-calibrated) to incorporate socio-economic data from the 1990 census (supplemented by current development data supplied by the City of Sedona) and the results of the Origin-Destination Study performed in January 1996. This data allows the model to provide the detail and flexibility necessary for supporting analyses of specific locations along the corridors.

The SR 89A corridor currently operates at a Level of Service (LOS) B, with an average speed of approximately 30 mph. However, several of the individual intersections exhibit unacceptable operations. The Y-intersection (signalized intersection at SR 89A and SR 179) operates at LOS F in the morning peak hour, and the Coffee Pot intersection (with SR 89A) operates at LOS E in the afternoon peak. Most of the unsignalized intersections along SR 89A from Dry Creek Road to the Y-intersection have movements that operate at LOS F in one or both of the peak periods. The Jordan intersection in the Uptown area operates at LOS E in the afternoon peak.

Traffic volumes on SR 89A and SR 179 are projected to increase 50% to 75% between 1995 and 2010. In the PM peak hour, the SR 89A corridor is predicted to operate at LOS F, primarily due to delays at the signalized intersections, including the Y-intersection. Unsignalized intersections will operate LOS F during both AM and PM peak periods.

Technical Memorandum #2 - Initial Concept Screening

The City of Sedona hosted a Concept Workshop in May 1996 to identify and discuss alternatives that would reduce the congestion and improve traffic operations at the SR 89A/SR 179 intersection. Representatives from ADOT, NACOG, and Yavapai County

attended. The alternatives were divided into three categories: intersection improvement concepts, bypass concepts, and parking concepts.

Intersection improvement concepts include improvements to the Y-intersection such as adding lanes, enhancing signal phasing, and modifying geometry (e.g., roadway striping). Three specific alternative plans were identified under this category:

1. Widen the existing Y-intersection by adding two right-turn lanes on northbound SR 179, and a left-turn lane on westbound SR 89A. The proposed "Y development" access would also be widened to include a right-turn lane. Traffic operations for the year 2010 would be improved to LOS D.

2. Minimal widening of the Y-intersection would consist of providing one additional right-turn lane on northbound SR 179 along with restriping and signal phasing improvements. The 2010 traffic model, however, predicted that no significant improvement in traffic operations would result.

3. Extend the westbound right-turn lane through the Y-intersection and provide eastbound SR 89A traffic with a U-turn movement to the Post Office. This alternative offers minimal improvement by eliminating left-turn conflicts at the post-office entrance. However, the predicted traffic operations would only be increased to LOS E.

Bypass concepts consist of those alternatives with new alignments to divert traffic away from the Y-intersection. Seven alternative alignments were identified at the workshop:

1. Ranger-Forest Bypass intersecting SR 89A at-grade provides an alternative route west of the Y-intersection and reduces the 2010 traffic by as much as 52%.

2. Ranger-Forest Bypass intersecting SR 89A with a grade separation and a half-urban diamond interchange, to the west offers a predicted 56% reduction in traffic at the Y-intersection.

3. A Ranger Road Only Bypass provides a roadway facility that ends at SR 89A with no provision for the Forest Road extension. This alternative offers a 43% reduction in the 2010 traffic at the Y-intersection.

4. A bypass east of the Uptown area would follow along the east side of Oak Creek and connect with SR 89A north of the Uptown business area. 2010 traffic volumes would be reduced by 21%.

5. A bypass east of the Uptown area with an extension of Wilson Canyon Road was discussed, but offers no additional improvement to the Y-intersection.

6. A south bypass along the Procnow-Brewer Road alignments was identified and predicted to reduce 2010 traffic volumes at the Y-intersection by 26%.

7. A south bypass along the Blackhawk-Brewer Road alignments results in a 19% reduction in traffic volume at the Y-intersection.

Parking Concepts consisted of alternatives that addressed trips with destinations in the Uptown/Oak Creek area. Two alternative plans were discussed:

1. Provide concentrated parking facilities at remote locations, offer transit/shuttle service, and remove, reduce, and/or restrict existing parking on SR 89A. If completely effective, this alternative would result in an 18% reduction in traffic volume at the Y-intersection.

2. Provide concentrated parking without transit/shuttle service which would limit travelers to services within walking distance of the parking facilities. If this alternative was implemented for the Uptown business area, it would offer little or no improvement to the Y-intersection. Vehicles would travel through the intersection to get to the parking facilities in the Uptown Area.

A fatal flaw analysis was performed on the 12 concepts identified in the workshop. The analysis evaluated each alternative based on travel demand, design standards, environmental considerations, project cost, and future considerations. Three were recommended for further evaluation:

- Widen the existing Y-intersection
- Ranger Road Extension
- East Bypass

Technical Memorandum #3 - Alternative Evaluation

The concepts recommended for further evaluation were refined by developing preliminary geometric layouts, consideration of access, and identification of Right-of-Way needs. From this, benefits and impacts for each alternative were determined, including budget level project costs.

The Ranger Road Extension was rated the highest in the alternative evaluation and recommended for implementation. The roadway is proposed to have a typical width of 4 lanes (two lanes each direction) with a raised landscaped median. It would be consistent with the 5-lane roadway being recommended by ADOT for the SR 179 corridor. It proposes a new signalized intersection approximately 1/4 mile west of the Y-intersection, and at the SR 179/Ranger Road intersection.

Right-of-Way will need to be acquired along the Ranger Road alignment, which in previous studies was estimated at $860,000. However, Right-of-Way would also be required for the widening as well as the east bypass alternatives. At a cost of $3.3 million (plus Right-of-Way), this alternative is more expensive than widening the Y-intersection ($1.2 million), but much less than constructing an east bypass ($12 million plus Right-of-Way). It offers the most benefit to improving operations at the Y-intersection. It also lends itself to developing remote parking facilities to further reduce congestion at the Y-intersection and in the Uptown business area.

Technical Memorandum #4 - Assessment of Proposed Corridor Improvements

Other concept corridor improvements presented in the "Uptown/Creek Area" and "West Sedona Commercial Corridor" studies were assessed to determine if they offer significant improvement, are considered cost effective, and can be implemented. The specific concept improvements proposed in the studies are:

- Pedestrian Crossings in the Uptown Area
- Uptown Area parking
- Access control measures and traffic calming features along SR 89A and SR 179.
- Transit Stop Locations

Controlled pedestrian crossings in the Uptown Area is very much needed. In July 1996, CH2M HILL performed a field evaluation of the pedestrian crossings between Jordan Road and Apple Avenue. The data collected clearly supports the immediate need for at least one signalized crosswalk location. Five individual locations and two multiple-signal locations were evaluated for signalized crossings:

1. Forest Road
2. Jordan Road
3. Mid-block Crossing (between Jordan and Apple)
4. Apple Avenue
5. Cliffs Drive
6. Jordan & Apple
7. Forest, Mid-block, & Cliffs

ADOT performed traffic signal needs studies for the Forest Road/SR 89A intersection (1994) and the Jordan Road/SR 89A intersection (1990). They concluded that signals are warranted at the Jordan Road intersection, but deferred making a recommendation regarding the Forest Road intersection since the Uptown Area was slated for further study.

Based on the evaluation, it was recommended that signals be installed at Forest Road, a Mid-block crossing, and at Cliffs Drive. The Mid-block crossing offers the most benefit for the pedestrian, but Forest Road would provide the most benefit for vehicle traffic. A signal at Cliffs Drive would be desirable if the Cliffs development project is completed.

Provision for additional parking facilities off of SR 89A will mitigate traffic congestion and parking problems. From the Origin - Destination Study, it was shown that the majority of parking in the Uptown Area is long term, and would probably utilize off-site parking. However, short term parking is essential for businesses (e.g., delivery vehicles, postal delivery).

Although it is not within the scope of this work to study parking needs, it is recommended that such study be performed and consider the following:

- Transit route and transit stop locations
- Limited on-street (SR 89A) parking
- Limited additional parking via side streets
- Utilization of private lots for public use
- Combining parking lots in the rear of businesses along SR 89A.

Access control and traffic calming features along the two highway corridors consist of reducing the number of private access drives, thus the number of left turn conflicts. This is done by providing raised medians, and combining access drives. A 4-foot raised median is recommended between Forest Road and Jordan Road in conjunction with a left-turn bay at Jordan. A 16-foot wide raised median should be installed from Jordan Road to Apple Avenue, and allow for a left-turn bay at Apple Avenue.

A concept plan for raised medians and combined access drives along SR 179 and SR 89A in West Sedona was determined based on a field reconnaissance survey. The results are presented graphically in the technical memorandum.

It is anticipated that a transit route to the Uptown Area and West Sedona would primarily run along SR 89A and SR 179 with connections to key retail destinations, establishments, parking facilities, and residential areas. The general location and number of transit stop locations is largely dictated by patronage, transit system operation, land-use patterns, and route. An in-depth transit needs study should be performed to determine whether the transit stop locations presented in the "Uptown/ Creek Area" and "West Sedona Commercial Corridor" studies are appropriate.

Technical Memorandum #5 - Implementation Plan for Circulation System Improvements

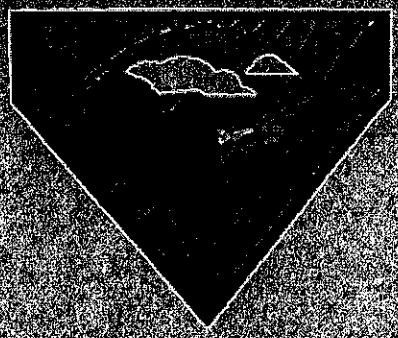
In summary, the recommendations made for improving the traffic operations along SR 89A and SR 179 consist of:

1. Ranger Road Extension
2. Raised Medians and elimination of access drives
3. Signals at Forest Road, Uptown Mall (mid-block crossing), and Cliffs Drive
4. Transit stops at key locations

Each of the recommended improvements was further broken into separate, identifiable component projects, and evaluated with respect to a number of factors addressing their benefits and impacts. The results of the evaluation determined the priority for having the projects completed and in use. An implementation schedule was then prepared based on which projects offered the most benefit for the least cost, and when the projects would be needed. The schedule is presented in the technical memorandum. In general, it shows that

a parking study be performed initially, followed by design and construction of the Uptown signals/medians, and the Ranger Road Extension. Raised medians and transit stops, while important, have a lower priority, and should be deferred until later.

Assuming an annual expenditure rate of $250,000, it would take approximately 13 years to fund and complete all of the recommended improvements. However, to implement the projects sooner, it is recommended the City pursue discussions with ADOT to establish joint funding of the projects and identify other funding sources.



Sedona Highway Corridor Assessment

Technical Memorandum #1

Identification and Analysis of Existing and Future Conditions

Prepared for

The City of Sedona

Prepared by

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May 1996

Technical Memorandum # 1 - Identification and Analysis of Existing and Future Conditions

Introduction

The community of Sedona relies heavily on SR89A and SR179 for the interconnection of local streets. As the City's only true arterial roadways, these facilities bear the burden of nearly all local trips and traffic associated with the estimated four million annual visitors. The Sedona Highway Corridor Circulation System Improvements Assessment (referred to in this document as the "corridor assessment") will evaluate alternatives for improvement along these corridors, and recommend the best course of action to reduce congestion.

This Technical Memorandum documents the initial efforts of the corridor assessment. The initial tasks include:

- **Final calibration of the Sedona Traffic Model,** based on the results of the recent (January 1996) Origin Destination study
- **Analysis of the Existing Conditions**
- **Analysis of the Future Conditions,** including the prediction of year 2010 land use conditions and traffic volumes.

Overview

In conjunction with the "Sedona Area Transportation Study" (PBQD, July 1991) a TRANPLAN Traffic Model was created for the City. Now the City is interested in investigating specific alternative solutions along segments of the SR89A and SR179 corridors. To accomplish this, the Sedona Traffic Model was updated and re-calibrated to provide the detail and flexibility necessary for supporting analyses of specific locations. Socio-economic data from the 1990 census (completed since the areawide transportation study was performed) was incorporated into the re-calibrated model.

The City of Sedona completed an Origin-Destination (O-D) study in January 1996. This study was initiated to obtain a better understanding of the trip patterns, and to help validate the Sedona Traffic Model. Trip patterns of the resident population and visitors were documented based on information obtained from highway interviews and questionnaires sent to residents.

Based on the results of the O-D study, the Sedona Traffic Model was modified to increase the accuracy of the predictions. This is discussed in more detail in the "Final Calibration of the Sedona Traffic Model" section of this document.

The traffic operations of the existing (1995) corridors were evaluated. The SR89A corridor operates at Level of Service (LOS) B, with an average speed of approximately 30 MPH. However several of the individual intersections exhibit unacceptable operations. For instance, the signalized intersection at the "Y" (SR89A and SR179) operates at LOS F in the morning peak and the Coffee Pot intersection operates at LOS E in the afternoon peak. Most of the unsignalized intersections along SR89A from Dry Creek Road to the "Y" have

movements that operate at LOS F in one or both of the peak periods. These results are depicted in Figure 1 and discussed in more detail in the "Analysis of Existing Conditions" Section of this document.

The design year for the corridor assessment is 2010, therefore land use and population of the area had to be estimated for the time period. The population projected for Year 2010 is 15,800 for the City of Sedona; this represents 89% of total City buildout based on the current land use plan.

Traffic volumes on SR89A and SR179 are projected to increase 50% to 75% between 1995 and 2010. In the PM Peak Hour the SR89A corridor is predicted to operate at LOS F, primarily due to significant delays predicted at the Shelby/Rodeo, Coffee Pot, and "Y" intersections. In the AM Peak Hour the SR89A corridor is predicted to operate at LOS D with an average speed of 19 MPH. Generally all of the unsignalized intersections along both corridors are predicted to have movements that operate at LOS F during both peak periods. These results are depicted in Figure 2 and discussed in more detail in the Future Conditions Section of this document.

EXISTING CONDITIONS

(YEAR 1995)

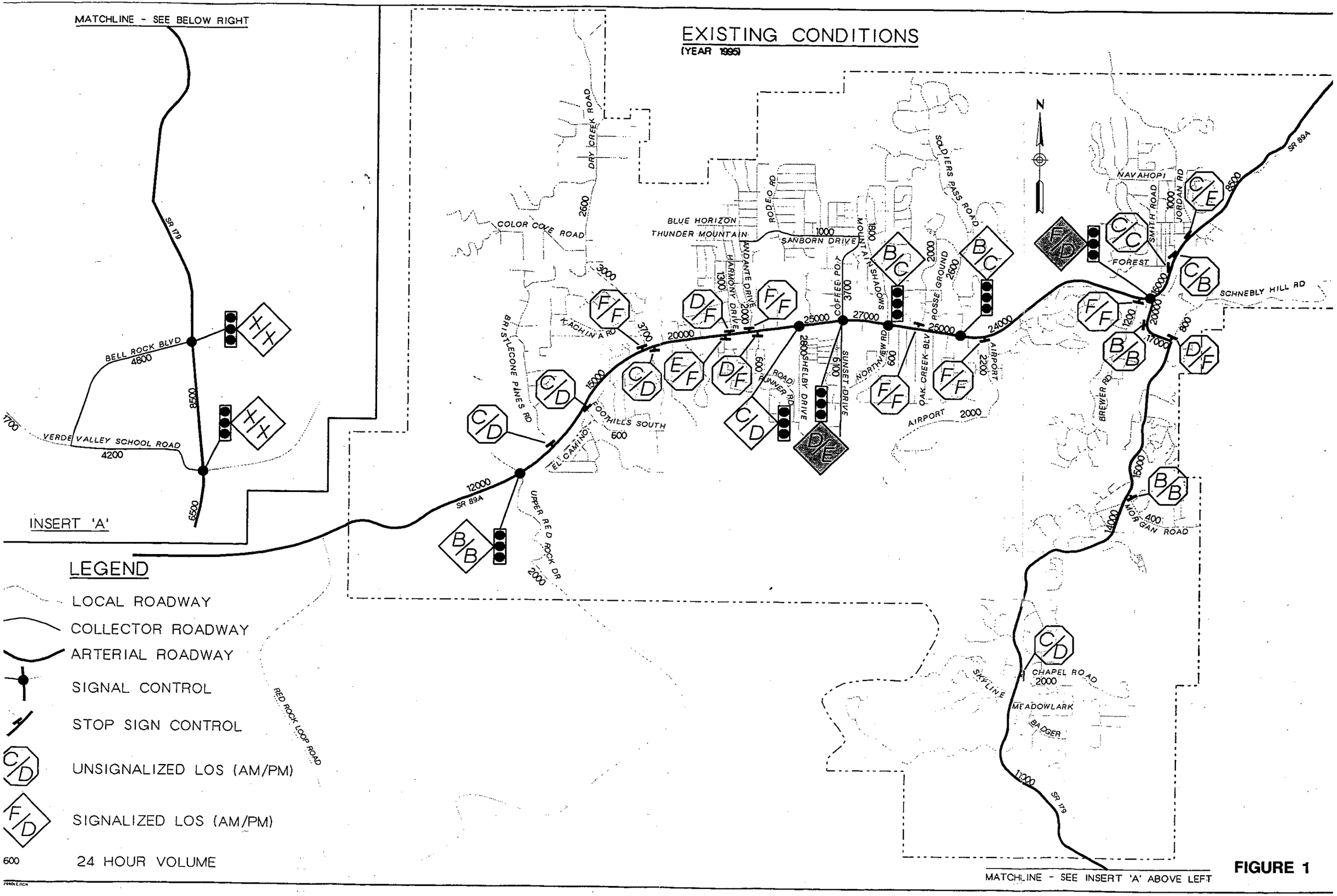


FIGURE 1

FUTURE CONDITIONS
(YEAR 2010)

MATCHLINE - SEE BELOW RIGHT

INSERT 'A'

MATCHLINE - SEE INSERT 'A' ABOVE LEFT

LEGEND

- LOCAL ROADWAY
- COLLECTOR ROADWAY
- ARTERIAL ROADWAY
- SIGNAL CONTROL
- STOP SIGN CONTROL
- C/D — UNSIGNALIZED LOS (AM/PM)
- F/D — SIGNALIZED LOS (AM/PM)
- 600 — 24 HOUR VOLUME

FIGURE 2

Final Calibration of the Sedona Traffic Model

The Final Calibration of the Sedona Traffic Model was completed based on information derived from the O-D study completed for the City in January 1996.

Data for the O-D study were collected from on-route interviews along SR89A and SR179, and from questionnaires sent to the residents of Sedona. One of the primary purposes of the O-D study was to obtain enough information to validate the Sedona Traffic Model.

Trip Generation

The data received from the O-D study were used to validate the Residential Trip Generation Rates within the City of Sedona Traffic Model. Trip generation represents the number of trips that are produced by each household on any given day. The resident questionnaire asked residents to list the number of commuter, shopping, and other trips they make each week. From this information current trip generation rates were derived as follows;

- **Commuter.** The trip rate used in the traffic model is within the confidence range of the value calculated from the Resident Survey. The average number commuter trips calculated from the resident questionnaires is 1.66 Trips/Household ± .42 Trips. The trip generation rate currently used in the City of Sedona Traffic Model for commuter trips (Home Based Work) is 1.33 Trips/Household.

- **Shopping.** The trip rate used in the model is within the confidence range of the value calculated from the Resident Survey. The average number of shopping trips calculated from the resident questionnaires is 3.07 Trips/Household ± 0.96 Trips. The trip generation rate currently used in the City of Sedona Traffic Model for shopping trips (Home Based Other) is 3.00 Trips/Household.

- **Total Trip Rate.** The current total trip rate used in the model is within the confidence range of the value calculated from the Resident Survey. The average number of total trips calculated from the resident questionnaires is 7.35 Trips/Household ± 2.66 Trips. the total trip generation rate (Productions + Attractions) used in the City of Sedona Traffic Model is 4.93 Trips/Household. Consideration was given to raise the total trip generation rate of Household trips, however, when higher rates were applied traffic volumes predicted on the state highway system increased significantly. Since the trip rate of 4.93 Trips/Household is within the confidence range of the value calculated from the Resident Survey and predicted 1995 volumes on the State Highway System is within 1% of the existing volumes, the trip generation rates were not modified.

Table 1 lists the final Trip Generation Rates contained in the Sedona Traffic Model;

Table 1
Trip Generation Rates

Trip Generation Category		Productions				Attractions			
scription	Unit	HB-Work	HB-Other	Non-HB	Tourist	HB-Work	HB-Other	Non-HB	Tourist
nstruction and Manufacturing	Empl.	0	0	1.5	0	1.8	2.4	2	0
olic Utility and Government	Empl.	0	0	1.5	0	2	2.4	2	0
ance, Insurance, Real Estate	Empl.	0	0	1.5	0	1.9	2.4	2	2
ail (Residential Based)	Empl.	0	0	5.5	1.1	1.9	14.9	5.5	2.8
ail (Tourist Based)	Empl.	0	0	3.1	4.7	1.8	2.6	3.1	8
vice, Professional	Empl.	0	0	0.8	0	2	1.2	0.8	0
ging	Empl.	0	0	2.3	5	1.6	2.1	2.3	5
seholds	Pop.	1.33	3	0	0	0	0.6	0	0
cial Generators	Trips	0	0.2	0.2	0.6	0	0.2	0.2	0.6

(HB = Home Based Trip)

Trip Distribution

Trip distribution is calculated by connecting a trip from a production trip end to an attraction trip end. Trips are primarily produced at households or businesses, and trips are primarily attracted to areas of employment and commercial centers. To validate the trip distribution of the Sedona Traffic Model areas of attraction are compared to data from the O-D study.

Commuter

Based on a comparison between the areas that attract the highest commuter trips, Uptown and Central West Sedona, the model is replicating the commuter pattern of the residents adequately. Area 4 (Uptown) is calculated to attract 25 ± 1.8% of the commuter trips based on the Resident Survey. Area 8 and 2 combined (Central West Sedona) is estimated to attract 38 ± 2.0% of the commuter trips. The City of Sedona Traffic Model currently attracts 27% of all commuter (Home Based Work) trips to Uptown, and 34% to the Central West Sedona area. The proportions of trips are not within the confidence range of the calculated proportions from the resident survey, however the general commuter pattern is being reproduced by the traffic model.

The City of Sedona Traffic model trip patterns of the residential shopping trips and tourist trips have been modified. These two types of trips are primarily attracted to Retail, Entertainment, Restaurant, and Lodging. These categories comprise the majority of the City of Sedona service industry, however, there are two distinctly different sets of services within the City. One set of services is geared to serve the residents of the City, such as; grocery stores, banks, post office, fast food, and hardware, and the second provides services to the tourist industry, including art galleries, restaurants, resorts, souvenir stores. To better replicate the travel patterns of residential shopping and tourist trips, service industry employment was divided into three employment categories. These categories include Lodging, Retail (Residential Based), and Retail (Tourist Based).

The trip patterns being produced by the Sedona Traffic Model are generally consistent with what was discovered during the O-D study.

Resident Shopping

The calculated proportion of resident shopping trips attracted to the Uptown area is only 7 ± 1.1% and the proportion to Central West Sedona is estimated at 70 ± 1.9%. The City of Sedona Traffic Model is currently attracting 12% of the resident shopping trips (Home Based Other) to Uptown, and the proportion of shopping trips attracted to Central West Sedona is 60%. These percentages do not closely match the results of the O-D study, however, the model is distributing a far greater number of residential shopping trips to West Sedona over Uptown. The model is replicating the general trip pattern that was revealed from the O-D study; further refinement of the model to more closely match the percentages calculated from the O-D study would require refinement of the Retail Employment categories. This would require an inventory of all retail businesses in the City and determination of additional Trip Generation Rates, an undertaking too costly for the minimal return in modeling accuracy.

Tourist

The On-route interviews give an indication of where the tourist trips are attracted to. The following reveals the number of tourist trip ends calculated for Uptown vs. Central West Sedona.

On-route Interview	Uptown	Central West Sedona
SR89A	35 ± 3%	21 ± 2.6%
SR179 Fri.	54 ± 3.1%	7 ± 1.6%
SR179 Sat	55 ± 3.1%	6 ± 1.5%

From the data presented, one would conclude, a far greater number of tourist trips are attracted to the Uptown area as compared to Central West Sedona. The City of Sedona Traffic Model currently predicts that 10% of the total tourist trip ends are attracted to Central West Sedona and 50% to the Uptown area. The model is distributing a significantly larger proportion of tourist trips to the Uptown area. These results are consistent with the trends depicted from the O-D study.

Trip Assignment

The validation of the trip assignment consists of checking the accuracy of any link data by comparing the model estimated assignments to traffic counts. When using the percent error method to validate the model, the following guidelines are suggested.

Functional Classification	Percent Error
Freeways	Less than 7 Percent
Principal Arterials	Less than 10 Percent
Minor Arterials	Less than 15 Percent
Collectors	Less than 25 Percent
Frontage Roads	Less than 25 Percent

Source: FHWA Calibration and Adjustment of System Planning Models; December 1990

For comparison with these guidelines, the roadway network used for the Sedona Traffic Model contains two functional classifications. SR89A and SR179 are Principal Arterials, and all other roadways are considered Collectors or Local Streets.

Table 2, titled "Network Loading Results," documents the locations where existing counts are available, and compares those to the modeled volumes at each location.

Principal Arterials

Existing traffic volumes are available at several locations along the SR89A and SR179 corridors, the modeled volumes was compared to these existing counts.

- **SR179.** Generally the model is predicting higher volumes than what was counted in the field. The average percent error for the three links along **SR179** is +4%; this is within acceptable guidelines.

- **SR89A.** The model is predicting the same travel patterns along **SR89A** as documented by the field counts. Volumes continuously rise as one travels from the west end of town to a peak between Coffee Pot Road and Soldiers Pass Road. Volumes decline slowly as one travels towards the "Y" intersection and then fall dramatically after leaving the Uptown area. The average percent error for the 6 links along **SR89A** is -1%; this is well within accepted guidelines.

Collectors and Local Streets

Generally the Collector and Local Streets are within the ±25% guidelines, except for some isolated locations as described below.

- **Apple Avenue.** The Centroid connector of Traffic Analysis Zone (TAZ) 45 that includes most of the commercial areas of Uptown is located on Apple Avenue. The centroid was located on Apple Avenue so the model could distribute trips from TAZ 45 to either Jordan Road or **SR89A** to better replicate the travel patterns in the Uptown area. However this means that volumes on Apple Avenue are extremely high compared to the existing traffic counts.

- **Brewer Road and Ranger Road.** These two roadways currently offer an alternative route to the "Y" intersection. Current traffic counts seem to indicate that some drivers are using this bypass today, however the model assigns traffic based on the shortest time to get from the origin to the destination. Using Ranger and Brewer Roads is not perceived as the shortest route for any of the trips that use the "Y" intersection as predicted by the model. Therefore predicted volumes on these streets are much lower than existing counts.

- **Northview Road.** Two count locations are used to validate traffic along Northview Road, one at SR89A and the other at Ross Road. The model is assigning traffic on Northview Road from the residential areas along the road. Comparing the count taken at Ross Road with the modeled volumes shows the calibration is within the accepted guidelines, however, the existing traffic count at SR89A includes traffic from the commercial areas along the highway and is much higher than the count at Ross Road. The layout of the TAZs along SR89A

Table 2

Network Loading Results

Run # 10

Date: 2/29/96

Road	Node#1	Node#2	Exist. Vol.	Load Vol	Difference	% Diff.
Airport	1421	1378	2,200	2,300	100	5%
Andante	1329	1372	2,300	2,000	-300	-13%
Apple Ave	1159	1150	1,060	1,700	640	60%
Brewer @ Brewer School	1463	1357	1,600	1,600	0	0%
Brewer Road @ 89A	1322	1268	2,400	1,200	-1200	-50%
Chapel	1626	1625	2,000	2,000	0	0%
Coffee Pot	1300	1336	3,100	3,700	600	19%
Dry Creek @ 89A	1348	1415	4,350	3,700	-650	-15%
Dry Creek @ Color Cove	1218	1056	2,200	2,600	400	18%
Jordan Road	1154	1116	3,100	3,100	0	0%
Meadow Lark	1648	1647	650	700	50	8%
Mount. Shadows	1283	1345	1,700	1,800	100	6%
Northview @ 89A	1412	1345	1,600	600	-1000	-63%
Northview @ Ross	1449	1412	600	600	0	0%
Ranger Road	1344	1322	1,300	800	-500	-38%
Sanborn @ Coffee Pot	1175	1178	1,860	1,600	-260	-14%
Sanborn @ Rodeo	1157	1176	1,500	900	-600	-40%
Soldiers Pass	1316	1376	2,800	2,600	-200	-7%
SR179	1367	1385	16,500	17,300	800	5%
SR179	1581	1518	13,600	14,600	1000	7%
SR179	1647	1676	11,200	11,300	100	1%
SR89A @ Airport	1378	1323	23,000	24,400	1400	6%
SR89A @ Forest Rd	1269	1234	16,800	16,400	-400	-2%
SR89A @ La Vista	1112	1034	8,300	8,500	200	2%
SR89A @ Roadrunner	1394	1393	19,200	17,500	-1700	-9%
SR89A @ URRL	1578	1562	12,400	13,300	900	7%
SR89A @ Verde Valley Ford	1332	1345	30,100	27,100	-3000	-10%
Sunset	1400	1336	4,500	6,100	1600	36%
URRL	1578	2023	2,050	2,000	-50	-2%
Residential Links			18,910	19,900	990	5%
Commercial Links			16,610	17,100	490	3%
State Highways			151,100	150,400	-700	0%

places these commercial trips directly onto SR89A and not onto Northview Road, therefore there is no increase in the modeled volumes. The predicted volume on Northview near SR89 is much lower than the existing counts because these commercial trips are not loaded onto Northview Road.

- **Sanborn Road.** The model appears to be producing the correct amount of traffic from the residential areas along Sanborn Road because validation along Coffee Pot and Andante Roads is within the accepted guidelines. However, the volume predicted along Sanborn Road near Rodeo Road is low compared to the existing counts. The model appears to be assigning trips to the nearest street that will take the trips out to SR89A, therefore trips near Coffee Pot Road use Coffee Pot Road instead of traveling down to Andante, and vice versa. However, from the traffic count data, more traffic is being observed in the center section of Sanborn Road than the model is predicting. Travelers choose which North-South roadway they will use based on other criteria such as overall driver comfort. Such factors may affect the drivers' route decision.

Final Calibration of the Model

The Sedona Traffic Model has been validated against the existing conditions. The final calibration of the model is complete, and the model can be used to predict future traffic volumes with reasonable confidence.

The underlying premise of traffic modeling is that travel behavior observed today will remain constant into the future. This is the reason significant time and effort is required to ensure the model is calibrated to the existing conditions. The trip generation rates shown in this document will remain constant for all future runs of the Sedona Traffic Model, until such time as another recalibration is initiated.

Analysis of the Existing Conditions

A traffic operations analysis was performed on the existing street network within the City of Sedona. The analysis included an arterial evaluation of SR89A, signalized intersection analysis, and unsignalized intersection analysis on primary stop sign controlled intersections along the SR89A and SR179 corridors.

The existing street network consists of two arterial corridors, SR89A and SR179. Almost all cross-town trips are forced to use one of the two arterial corridors, because the remainder of the roadway system consists of feeder roadways from neighborhoods to the state highways. Very few inter-neighborhood connections exist that would allow a cross-town trip to avoid the arterial corridors.

Many of the roadways that collect traffic from the neighborhoods to the state highways were included in the analysis of the existing conditions including;

- Airport Road
- Andante Drive
- Apple Ave.
- Arroyo Pinon Road
- Brewer Road
- Bristlecone Pines Road
- Chapel Road
- Dry Creek Road
- Foothills South Drive
- Forest Road
- Harmony Drive
- Jordan Ave
- Morgan Road
- Posse Grounds Road
- Schnebly Hill Road
- Stuz Bearcat Road
- Thunderbird Road

These roadways intersect SR89A or SR179 as Stop Sign Controlled Intersections, therefore they have been analyzed using the Unsignalized Intersection procedures documented in the "Highway Capacity Manual."

Traffic Assignment

The Sedona Traffic Model predicts 24-hour volumes for the various links of the street network, however operational analysis calculates the traffic conditions for a peak one hour interval. The daily traffic volumes generated by the model must first be converted to peak hour volumes.

Typically the peak hour is expressed as a percentage of the 24-hour volume, i.e. the AM Peak Hour = 9% of the 24-hour volume, factor is commonly referred to as the K factor. The peak hour is usually associated with a high percentage of commuter drivers traveling to or from work, which suggests a peak direction can be associated with the peak hour (i.e. the

peak direction is towards downtown Phoenix in the morning and away in the afternoon). The percentage of drivers driving in the peak direction is commonly referred to as the Directional Distribution Factor.

A third factor required when performing operational analysis is the Peak Hour Factor (PHF) which converts the highest 15 minute peak of volume to become the volume for the entire peak hour. Essentially the question being asked in an operational analysis is "What is the traffic going to be like in the worst 15 minutes of the worst hour of the day?" In major metropolitan areas the peak hour factor is not as significant as in a City such as Sedona, because in a major metropolitan area the peak period may be spread over several hours, and the congestion experienced in the worst 15 minutes is nearly the same as the entire hour. However in a smaller City the first 15 minutes after quitting time could have significantly more congestion than 30 minutes after quitting time, because in 30 minutes many people may already be home and off the road.

Based on week long traffic counts, that were performed during the O-D study, these important factors were determined for the City of Sedona. Table 3 displays on overview of the traffic data, and the resulting K Factor, Directional Factor, and Peak Hour Factors. The traffic factors derived from the traffic counts are accurate for the state highway system, however local and collector roads generally have higher peaking characteristics then arterial facilities. The following guidelines were established to convert the 24-hour volumes to peak hour volumes.

K Factors

Facility	AM Peak	PM Peak
Arterials	8.0%	10.0%
Collectors	10.0%	12.0%
Local Streets	12.0%	15.0%

Directional Factors

Area	Peak Direction	Non Peak Direction
Uptown	65%	35%
Oak Creek	55%	45%
West Sedona	52%	48%

Peak Hour Factor

Citywide	0.90

Arterial Streets

An Arterial Street is defined by the "Highway Capacity Manual" as a signalized street that serves through traffic primarily and provides access to abutting properties as a secondary

Table 3
City of Sedona
Traffic Count Overview

SR 179

Date	Day	SB AM	SB PM	SB 24HOUR	NB AM	NB PM	NB 24HOUR	TOTAL 24 HOUR	%K AM	%K PM	%DIR AM	%DIR PM	AM PHF	PM PHF
10/31/95	TUE	450	683	6222	577	508	6284	12506	8.21%	9.52%	56%	57%	0.93	0.84
11/1/95	WED	452	626	6120	582	546	6188	12308	8.40%	9.52%	56%	53%	0.95	0.94
11/2/95	THU	508	621	6454	568	595	6411	12865	8.36%	9.45%	53%	51%	0.94	0.91
11/3/95	FRI	464	683	6434	761	750	7325	13759	8.90%	10.42%	62%	48%	0.93	0.89
11/4/95	SAT	561	759	6923	590	659	6402	13325	8.64%	10.64%	51%	54%	0.78	0.92
11/5/95	SUN	471	738	6315	563	562	6124	12439	8.31%	10.45%	54%	57%	0.99	0.97
							AVERAGE	***12867***	***8.47%***	***10.00%***	***56%***	***53%***	***0.92***	***0.91***

SR 89A (North of Uptown)

Date	Day	SB AM	SB PM	SB 24HOUR	NB AM	NB PM	NB 24HOUR	TOTAL 24 HOUR	%K AM	%K PM	%DIR AM	%DIR PM	AM PHF	PM PHF
10/31/95	TUE	230	310	2858	419	555	5397	8255	7.86%	10.48%	35%	64%	0.85	0.94
11/1/95	WED	239	285	2751	445	532	5264	8015	8.53%	10.19%	35%	65%	0.88	0.91
11/2/95	THU	266	316	3069	511	549	5824	8893	8.74%	9.73%	34%	63%	0.93	0.97
11/3/95	FRI	325	398	3568	657	813	7039	10607	9.26%	11.42%	33%	67%	0.86	0.87
11/4/95	SAT	365	460	4136	668	911	7937	12073	8.56%	11.36%	35%	66%	0.87	0.85
11/5/95	SUN	210	455	3369	427	816	6408	9777	6.52%	13.00%	33%	64%	0.92	0.84
							AVERAGE	***9603***	***8.24%***	***11.03%***	***34%***	***65%***	***0.89***	***0.90***

SR 89A (East of Airport Rd)

Date	Day	WB AM	WB PM	WB 24HOUR	EB AM	EB PM	WB 24HOUR	TOTAL 24 HOUR	%K AM	%K PM	%DIR AM	%DIR PM	AM PHF	PM PHF
10/31/95	TUE	1023	1173	13576	1093	1271	13911	27487	7.70%	8.89%	52%	48%	0.97	0.94
11/1/95	WED	1069	1211	12863	1065	1207	13298	26161	8.16%	9.24%	50%	50%	0.86	0.95
11/2/95	THU	1061	1221	13254	1095	1241	13956	27210	7.92%	9.05%	51%	50%	0.93	0.93
11/3/95	FRI	1112	1253	13332	1135	1318	13809	27141	8.28%	9.47%	51%	49%	0.95	0.95
11/4/95	SAT	866	1077	11659	915	1231	12836	24495	7.27%	9.42%	51%	47%	0.80	0.88
11/5/95	SUN	1025	1083	11921	1095	1071	12302	24223	8.75%	8.89%	52%	50%	0.93	0.91
							AVERAGE	***26120***	***8.01%***	***9.16%***	***51%***	***49%***	***0.91***	***0.93***

function, having signal spacing of 2 miles or less. The only facility in Sedona that meets this definition is SR89A from Upper Red Rock Loop Road to the "Y."

SR89A was analyzed as an arterial using the Highway Capacity Software and 1995 traffic volumes with the following results.

Arterial Analysis SR89A

Period	Direction	LOS	Average Speed
AM Peak	Eastbound	B	32.3 MPH
AM Peak	Westbound	B	33.8 MPH
PM Peak	Eastbound	B	31.1 MPH
PM Peak	Westbound	B	30.2 MPH

The Arterial Program incorporates the results of the signalized intersections to determine the predicted average speed.

Signalized Intersections

The signalized intersections were analyzed by using the existing signal timing, provided by ADOT, to the turning movements generated by the Sedona Traffic Model. The 24-hour turning movements were converted to peak hour volumes using the guidelines listed above. The 1995 turning movement count calculation sheets are provided in Appendix 1.

In December 1995 and January 1996 the ADOT Traffic Engineering Section recorded turning movement counts at the signalized intersections along SR89A. To further validate the Sedona Traffic Model the signalized intersections were analyzed with the recorded turning movements and LOS compared. The results of the analysis are as follows;

Signalized Intersection Level of Service

Intersection Location	AM Peak Hour		PM Peak Hour	
	(Model)	(Counts)	(Model)	(Counts)
The "Y"	F	E	D	E
Soldiers Pass Road	B	B	C	C
Mountain Shadows	B	B	C	B
Coffee Pot	D	C	E	D
Shelby	C	B	D	C
Upper Red Rock Loop	B	B	B	B

Generally the Sedona Traffic Model is predicting turning volumes slightly higher than the existing conditions, therefore in many cases the LOS predicted by the model is conservative.

Stop Controlled Intersections

The primary neighborhood streets that have unsignalized intersections with the two state highways were included in the analysis of existing conditions. Typically the left turning movements at unsignalized intersections require the largest gaps in traffic to complete resulting in more delay. The Unsignalized LOS calculated for the left turn movements in the AM and PM peak hours for each intersection are included in Tables 4 , 5, and 6.

Left turning movements from the side streets exhibit worst LOS as the volumes and number of lanes on the major street increase. Left turning movements from side streets experience LOS E and F along SR89A from Dry Creek Road to the "Y" where volumes are the highest. Corresponding movements on SR179 have better LOS since the volumes and number of through lanes are reduced.

Table 4

Unsignalized Intersection Analysis

SR89A - AM Peak Hour - 1995 Traffic

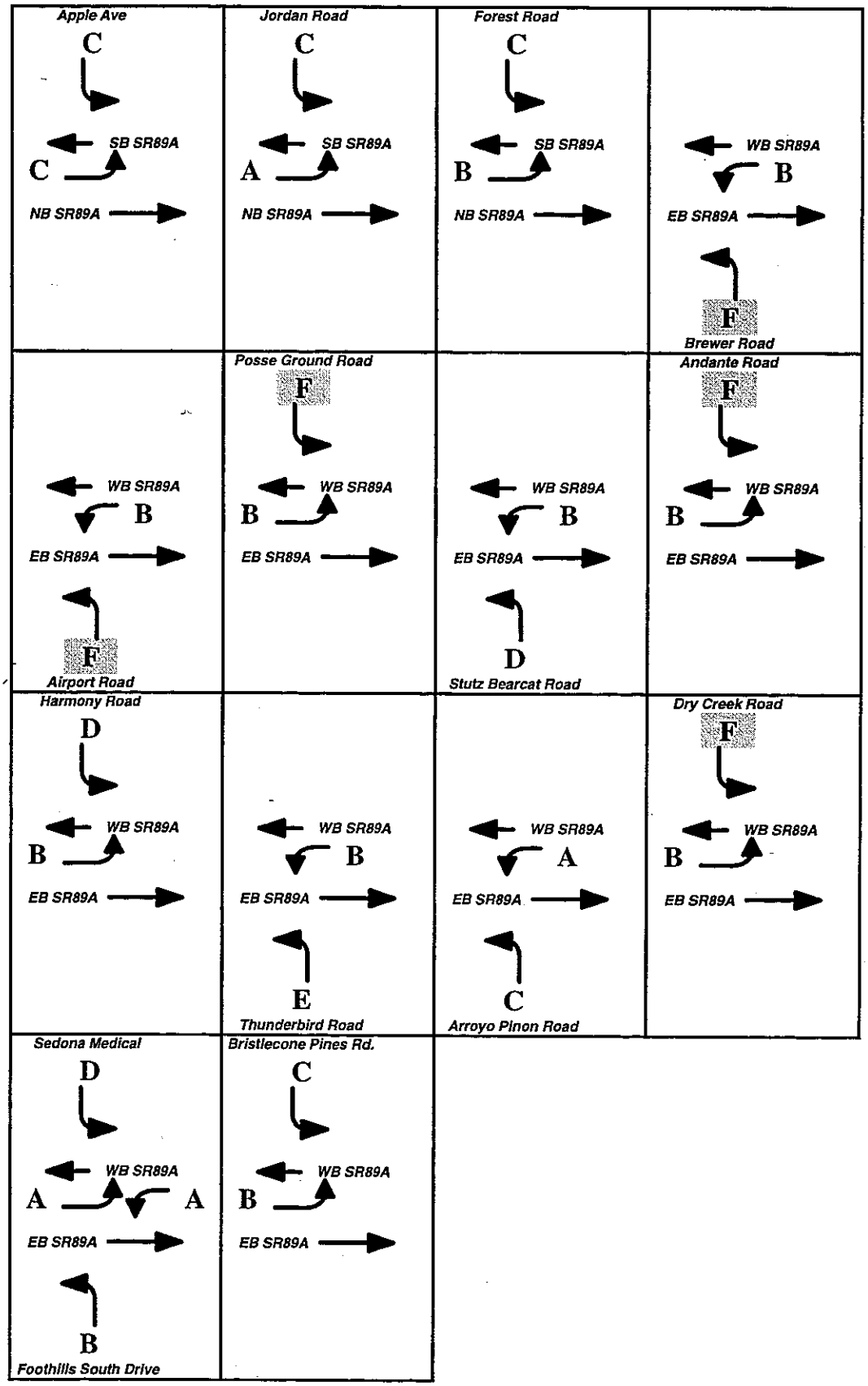


Table 5

Unsignalized Intersection Analysis

SR89A - PM Peak Hour - 1995 Traffic

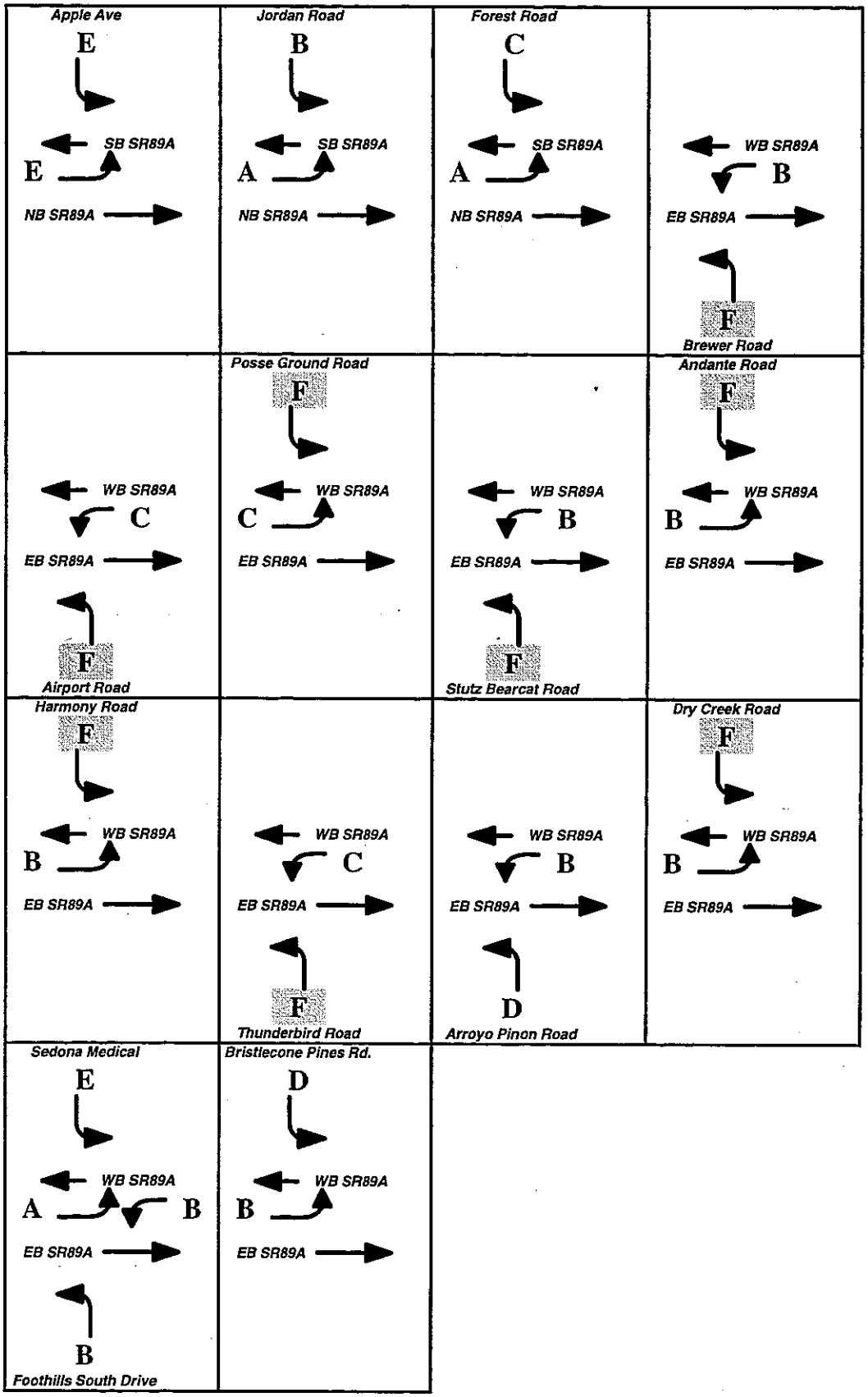
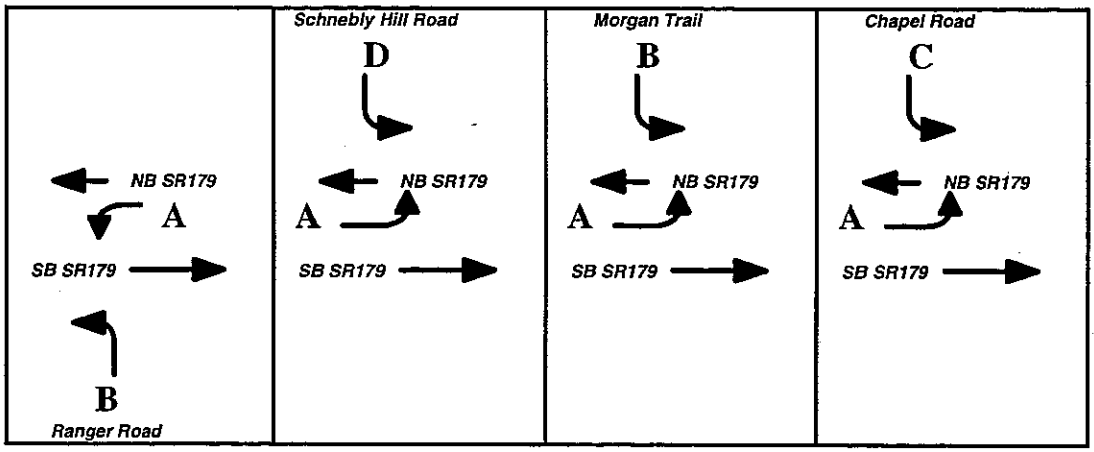


Table 6

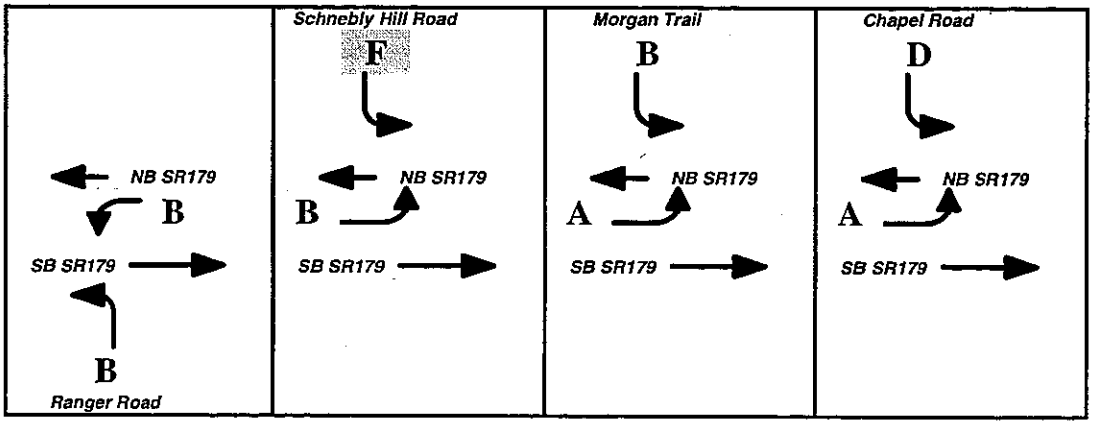
Unsignalized Intersection Analysis

SR179 - AM Peak Hour - 1995 Traffic



Unsignalized Intersection Analysis

SR179 - PM Peak Hour - 1995 Traffic



Analysis of the Future Conditions

A traffic operations analysis was performed on the anticipated future street network within the City of Sedona. The analysis included; an arterial evaluation of SR89A, signalized intersection analysis, and unsignalized intersection analysis on primary stop sign controlled intersections along the SR89A and SR179.

The initial step to completing an evaluation of the future conditions is to establish the future design year. The Year 2010 was selected to be consistent with the design year selected for the "Sedona Area Transportation Study" (PBQD 1991).

Buildout Conditions

Sedona is unique in that it is completely surrounded by national forest lands. The National Forest Service has previously identified two major areas of the Coconino National Forest that could be considered for exchange, however, the City land use plan calls for these areas to remain public space. This means that once the private land within the City is completely occupied, the growth of the City is recommended to be limited to redevelopment instead of expansion.

The current land use plan identifies the type of development the City will allow to be built on the remaining private lands. The buildout condition is when all remaining private lands are developed as described in the land use plan.

The City of Sedona, MIS Division provided property line and building footprint information to be used to inventory vacant lands. All new developments, either planned or under construction, known to the City staff at the time of this evaluation (April 1996) were added to the existing information. The remaining vacant properties were inventoried and planned land use applied. From this analysis the anticipated number of dwelling units and acreage of commercial development was determined at buildout.

Using information from the 1990 Census and an employment inventory performed by the City staff, the anticipated population and employment of the City of Sedona at buildout was calculated. These numbers are as follows.

City of Sedona Population and Employment Estimates

	1994	Buildout
Population	8,700 Persons *	17,800 Persons
Employment	5,700 Persons	8,500 Persons

* Since the completion of the calibration for the Sedona Traffic Model, the 1995 Special Census has documented the 1995 city population at 8,910.

Design Year Conditions

The Sedona Community Plan forcasted population for the Year 2010, and concluded that a population of 15,800 was appropriate. To remain consistent with the Community Plan, the assumption is made that in the Year 2010 the City of Sedona will be at 89% of buildout.

	Year 2010
Population	15,800 Persons
Employment	7,600 Persons

Year 2010 conditions in areas outside the City limits could not be estimated using a comprehensive land use plan. Population and employment estimates for these areas were established using a growth rate. The growth rate was calculated based on the average growth from 1980 to 1995, and assuming this rate of growth will remain constant through the Year 2010. ***The growth rate used for this study is 3.30%.*** In addition to population and employment, this growth rate was applied to the existing traffic counts on SR89A and SR179 at the edge of the study limits as follows.

Traffic Projections for the State Highway System

Location	1995 Daily Traffic	Year 2010 Daily Traffic
SR89A West of URRL	12,000 Vehicles	21,000 Vehicles
SR89A North of Uptown	8,500 Vehicles	15,000 Vehicles
SR179 South of VOC	7,000 Vehicles	12,000 Vehicles

Street Network

Several programmed improvements and planned developments will add new links in the street network in and around the City of Sedona by the year 2010. The new roadway links were added to the Sedona Traffic Model to create the Year 2010 Base Network which becomes the base condition for evaluating alternative improvement scenarios.

New Roadway Connections and Improvements, Year 2010 Base Network

- **Rodeo Road**. Extension of Rodeo Road to create a through connection from Sanborn Drive to SR89A at Shelby Drive.
- **Dry Creek Road**. Installation of a Traffic Signal at SR89A, and realignment of Arroyo Pinon to align opposite of Dry Creek Road.
- **Thunder Mountain Road**. Extension of Thunder Mountain Road west to Dry Creek Road.
- **Navoti Drive**. Construction of Navoti Drive from Compactor Road to Juniper Road.
- **Airport Road**. Extension of Airport Road north of SR89A, and connection to Soldiers Pass Road.

- **The "Y."** Implementation of the "Y" development, producing a fourth leg of the intersection, and a connection to Forest Road.
- **Red Rock Crossing.** Replacement of the bridge at Red Rock Crossing, creating a connection between Upper Red Rock Loop and Verde Valley School Road.
- **SR89A.** Widening of SR89A to 4 lanes with turn lanes to the west study limit.
- **SR179.** Widening of SR179 to 4 lanes with turn lanes from the "Y" to the south study limit.

Daily traffic volumes projected by the Sedona Traffic Model for year 2010 are shown in Figure 2.

Arterial Streets

SR89A was analyzed as an arterial using the Highway Capacity Software and 2010 traffic volumes with the following results;

Arterial Analysis SR89A

Period	Direction	LOS	Average Speed
AM Peak	Eastbound	D	18.6 MPH
AM Peak	Westbound	C	27.8 MPH
PM Peak	Eastbound	F	Not Applicable
PM Peak	Westbound	F	Not Applicable

The arterial analysis incorporates the results of the signalized intersection analysis to determine the predicted average speed.

Signalized Intersections

The signalized intersections were analyzed by using the Highway Capacity Software and the turning movements generated by the Sedona Traffic Model. The 24-hour turning movements were converted to peak hour volumes using the guidelines listed previously. The 2010 turning movement count calculation sheets are provided in Appendix 2.

The results of the analysis are as follows.

Signalized Intersection Level of Service

Intersection Location	AM Peak Hour	PM Peak Hour
The "Y"	F	F
Soldiers Pass Road	C	D
Mountain Shadows	D	D
Coffee Pot	F	F
Shelby	F	F
Dry Creek Road	C	E
Upper Red Rock Loop	B	C

Stop Controlled Intersections

As discussed in the overview section of this document, numerous streets that have unsignalized intersections were included in the analysis of future conditions. Three intersections were included in the year 2010 analysis in addition to those listed in the existing analysis. These include:

- Thunder Mountain / Dry Creek Road
- Navoti Drive / SR89A
- North Airport Road / SR89A

Typically the left turning movements at unsignalized intersections require the largest gaps in traffic to complete, therefore, more delay is associated with these movements. The Unsignalized LOS calculated for the left turn movements in the AM and PM peak hours for each intersection are included in Tables 7 , 8, and 9.

Table 7

Unsignalized Intersection Analysis

SR89A - AM Peak Hour - 2010 Traffic

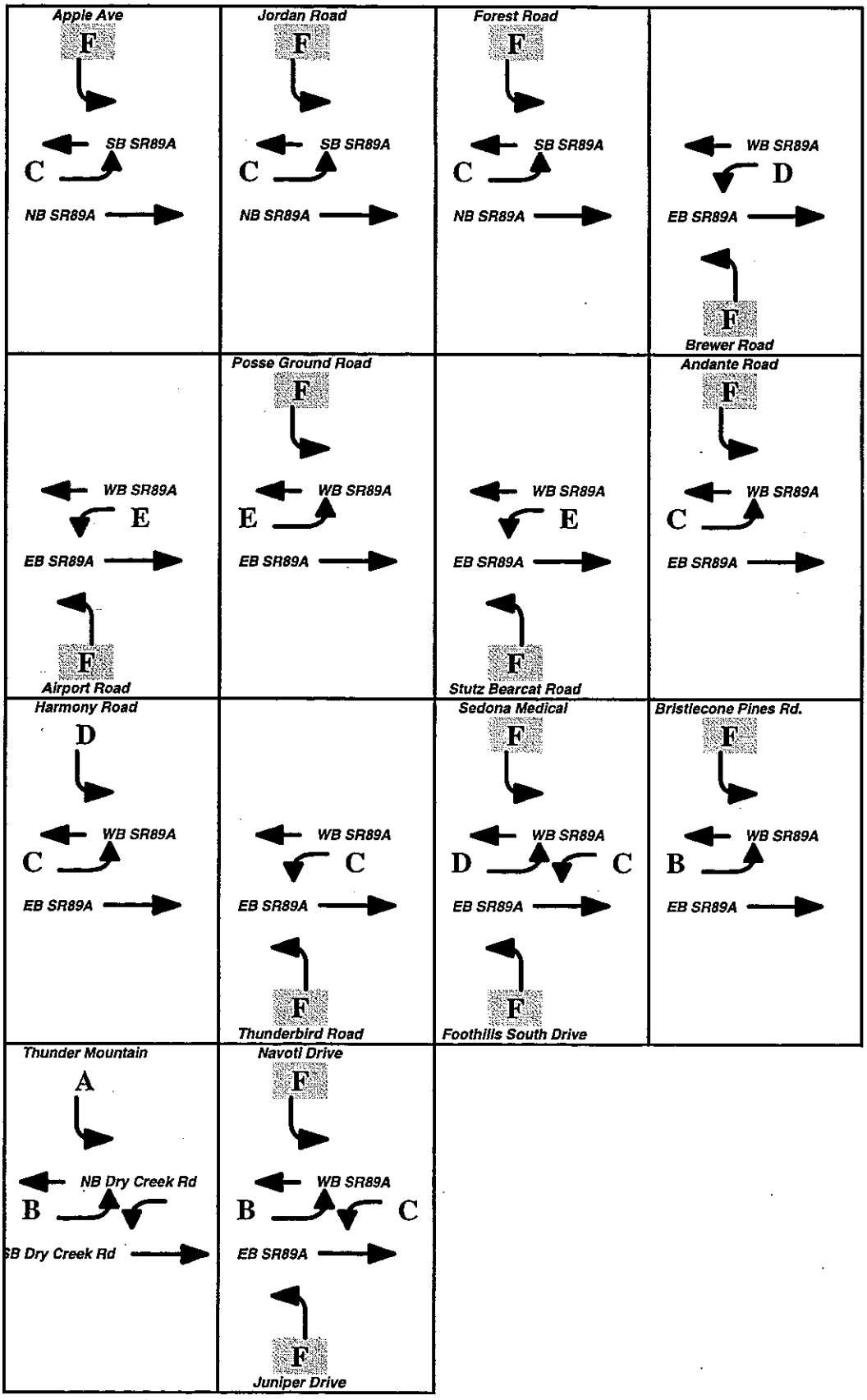


Table 8

Unsignalized Intersection Analysis

SR89A - PM Peak Hour - 2010 Traffic

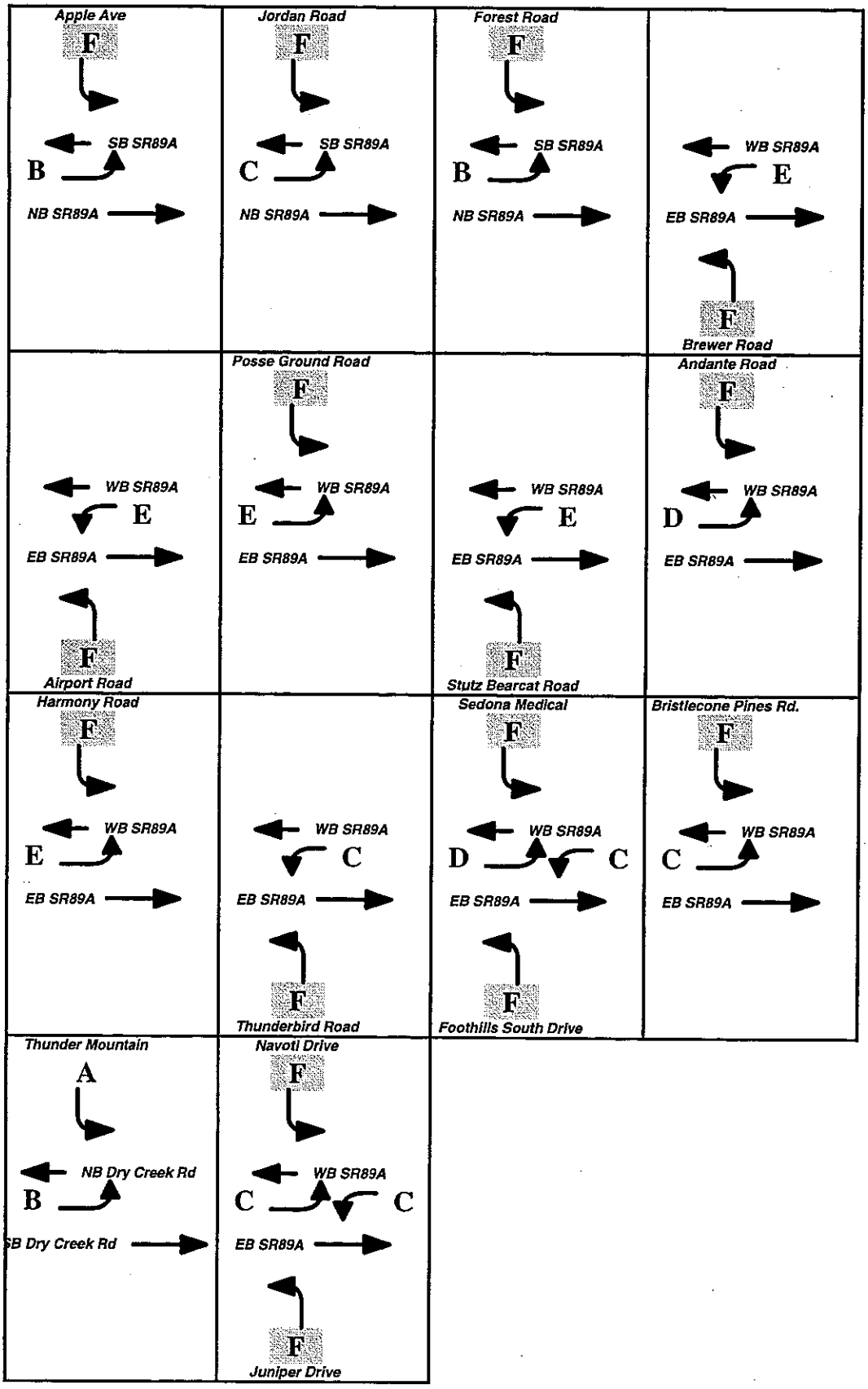
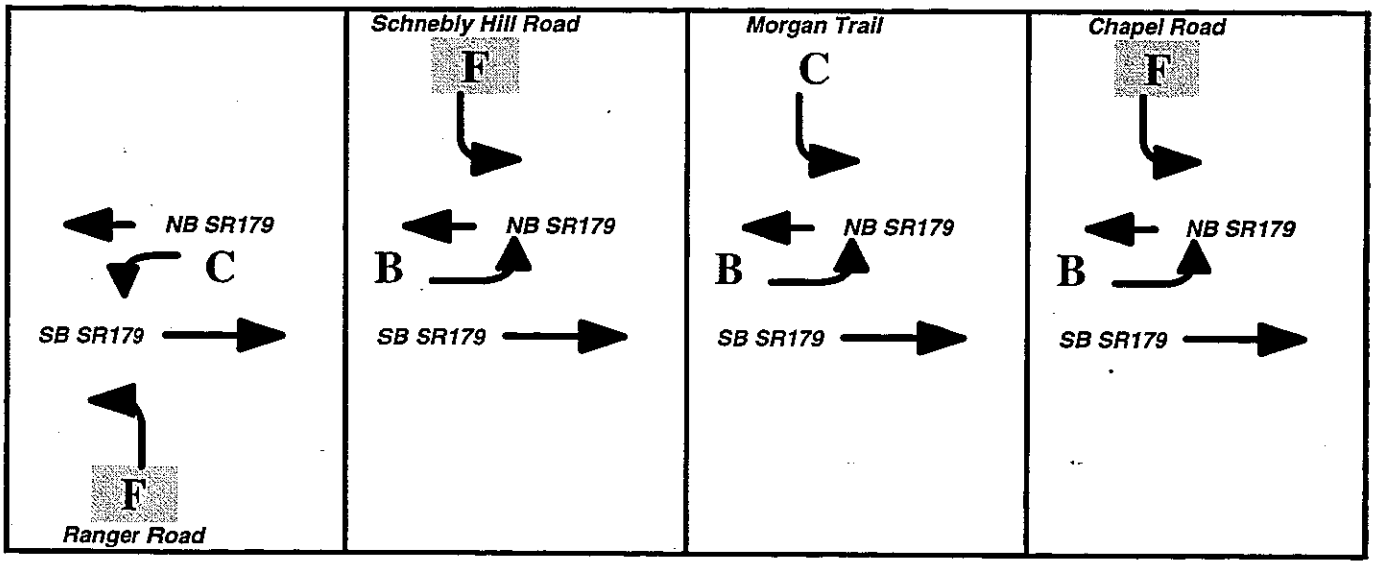


Table 9

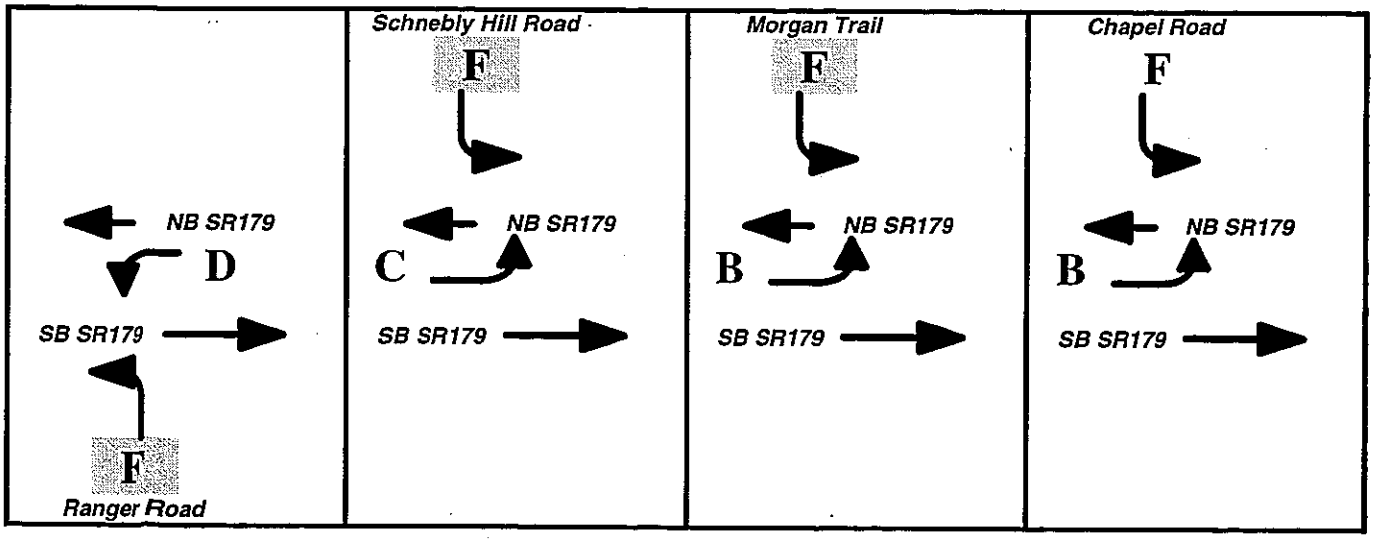
Unsignalized Intersection Analysis

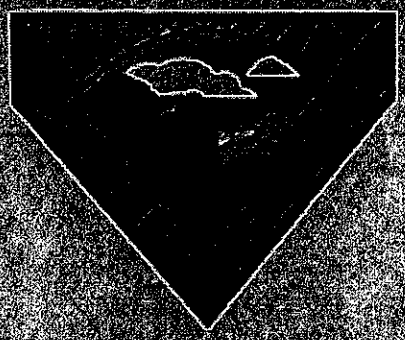
SR179 - AM Peak Hour - 2010 Traffic



Unsignalized Intersection Analysis

SR179 - PM Peak Hour - 2010 Traffic





Sedona Highway Corridor Assessment

Technical Memorandum #4

Assessment of Proposed Corridor Improvements

Prepared for

The City of Sedona

Prepared by

CH2M HILL

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Tempe, Arizona 85282

October 1996

Technical Memorandum #4 - Assessment of Proposed Highway Corridor Improvements

This technical memorandum addresses an engineering evaluation of roadway enhancements that have been proposed to improve access, traffic flow, and pedestrian traffic conditions along SR 89A and SR179 within the City of Sedona. It is intended to evaluate the specific concepts that were presented in the "Uptown / Creek Area" and "West Sedona Commercial Corridor" studies. The proposed Corridor improvements consist of:

- Pedestrian Crossings in the Uptown Area
- Uptown Area - Parking
- Access control measures and traffic calming features
- Transit stop locations

Pedestrian Crossing Locations in the Uptown Area

The Uptown business area along SR 89A realizes a substantial amount of pedestrian traffic from visitors and local residents alike. Pedestrian traffic is integral with the vehicular traffic, and plays an important role in the overall movement of people and goods. The flow of pedestrian traffic is vital to the economic health of the Uptown businesses.

Pedestrian crossings in the Uptown Area are currently uncontrolled causing significant conflict with the vehicular traffic. Since there are no controlled or defined locations to cross SR 89A, pedestrians often times become trapped in the center of the roadway until they can safely complete their crossing. Vehicle speeds vary significantly depending upon the presence of pedestrians in the right-of-way, resulting in inefficient traffic flow and the potential for accidents.

Thus, an evaluation of pedestrian crossings was conducted to determine the most effective locations. This evaluation is based on available traffic studies and field observations, recognizing that additional traffic studies may be required to determine the needs for signals at certain intersections. Elements of discussion include the warrants for signalized crossings, operational considerations, specific aspects of the various potential locations, and recommendations to the City. This analysis is not intended to recommend design parameters. Such considerations (e.g. signal timing) must be verified through further study of the signalization needs.

General

In general, pedestrian crossings can be either unsignalized or signalized. Unsignalized crossings are most always located at stop sign controlled intersections. They are often signed to forewarn motorists and have well defined pavement markings to assist the pedestrian. They have a distinct economic advantage over signalized crossings, but are less effective or safe

when pedestrian and vehicular traffic is appreciable. Unsignalized crossings should not be considered on SR 89A.

Traffic signals provide a controlled operation where both driver and pedestrian movements are established through timed assignment of the right-of-way. Pedestrian signals are part of the roadway traffic signalization system, and must be considered in conjunction with the optimal location of vehicular traffic signals. Operational requirements (e.g. spacing, phasing, timing) are determined based on an analysis of the traffic conditions and the physical conditions such as sight distance, roadway width, and vehicle speed.

Data Collection

ADOT performed traffic signal needs studies for the Forest Road/SR 89A intersection (December 1994), and the Jordan Road/SR 89A intersection (April 1990). The Jordan Road study concluded that a signal was appropriate. Five of the eleven warrants described in the MUTCD were satisfied. The Forest Road intersection study concluded that three of the warrants were satisfied. However, a signal was not recommended since Jordan Road was already considered for a signal, and the Uptown Area was slated for further study. Both traffic signal needs studies are presented in Appendices A and B. The pedestrian data collected as part of those studies is summarized in Table 1.

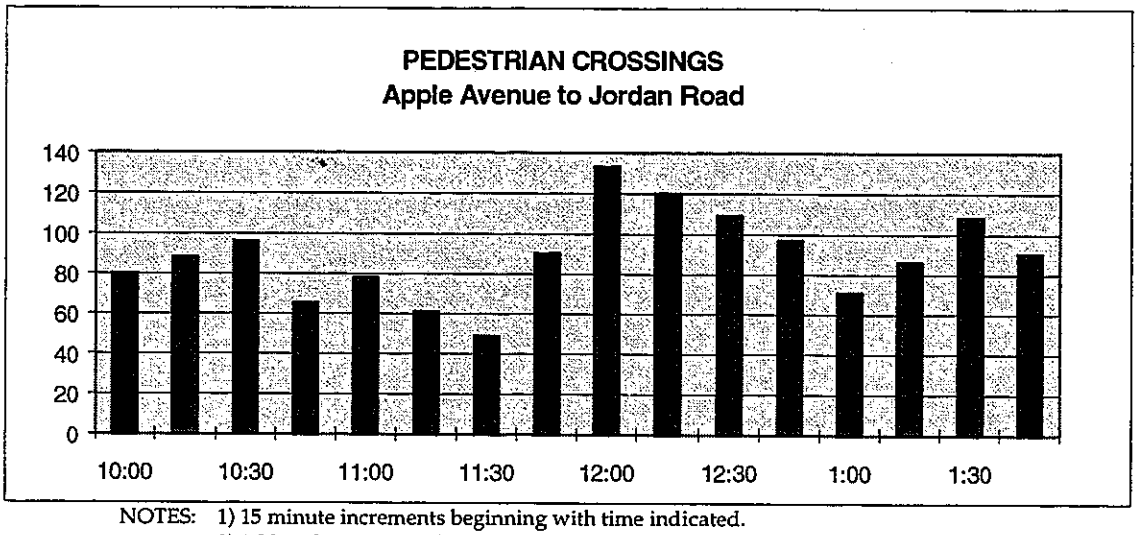
Table 1 - Total Pedestrian counts from ADOT traffic signal needs studies

LOCATION	A.M. PEAK (Total Volume)	P.M. PEAK (Total Volume)	24 - HOUR Volume
Forest Road	106	87	1084
Jordan Road	228	244	2927

The Sedona Traffic Model indicates that Jordan Road has 1,000 VPD (vehicles per day)and Forest Road has 800 VPD, while SR 89A boasts 18,100 VPD in the Uptown Area, and 8,100 VPD north of town. The traffic volumes for SR 89A in the model are consistent with actual 24-hour count data presented in both ADOT traffic studies. Forest Road and Jordan Road traffic model volumes, however, were substantially less than the measured traffic data at each location. Consequently, the measured traffic data was used in the supporting analyses.

On July 20, 1996 (Saturday), CH2M HILL videotaped pedestrian crossings on SR 89A between Apple Avenue and Jordan Road. The videotape recorded pedestrian crossings between 10:00 a.m. and 2:00 p.m. Figure 1 presents a summary of the number of pedestrians crossing SR 89A in 15 minute increments during that period.

Fig 1 - SR 89A Pedestrian Crossing Data Summary



NOTES: 1) 15 minute increments beginning with time indicated.
2) 1:30 and 1:45 intervals were prorated base on 5 to 7 minutes of observation, respectively.

Pedestrian Signal Warrants - MUTCD Criteria

There are 11 warrants, or conditions, for placement of a traffic signal as presented in Part IV, Section C of the Manual on Uniform Traffic Control Devices (MUTCD), prepared by the Federal Highway Administration. These warrants are also provided in the ADOT traffic needs studies presented in the appendix. An analysis of each of the warrants in accordance with the MUTCD is necessary to determine if an intersection should be signalized. At least one of the warrants must be met to justify signalization. However, as stated in the MUTCD, engineering judgment must be used to assess whether the intersection's operation and safety could be improved by signalizing the intersection.

There are three warrants that consider pedestrians as a direct factor in the determination. They are:

Warrant #3 - Minimum pedestrian volume. The predominant criteria stated in this warrant requires a pedestrian volume crossing the major street at an intersection or mid-block location during an average day to be 100 or more for each of any four hours; or 190 or more during any one hour. It also requires that there be fewer than 60 gaps per hour in the traffic flow that would allow a pedestrian to cross the roadway. Other criteria for this warrant are discussed in the MUTCD and presented in the ADOT - Forest Road traffic study included in the appendix.

Warrant #4 - School crossings. This warrant does not apply to the study location, but is presented in full in the ADOT - Forest Road traffic study included in the appendix.

Warrant #6 - Accident experience. Generally, if there are five or more reported accidents within the past 12 months that can be attributable to the

lack of signalization, then the warrant may be satisfied. Accident experience considers both vehicular and pedestrian related incidents. This warrant is also presented in the appendix.

As shown in Figure 1, there were more than 270 crossings in each of the four hours of data recording, and nearly 460 crossings during the noon hour. In addition, the number of gaps in the traffic flow for each of the four hours is presented in Table 2. Since the duration for crossing SR 89A is approximately 10 seconds (36 feet/3.5 fps) , gaps greater than 10 seconds long were recorded. Thus the Warrant #3 is clearly met.

Table 2 - Gaps in Traffic Flow

TIME PERIOD	NUMBER OF GAPS GREATER THAN 10 SECONDS
10:00am to 11:00am	39
11:00am to 12:00pm	24
12:00pm to 1:00pm	17
1:00pm to 2:00pm	12

Alternative Locations

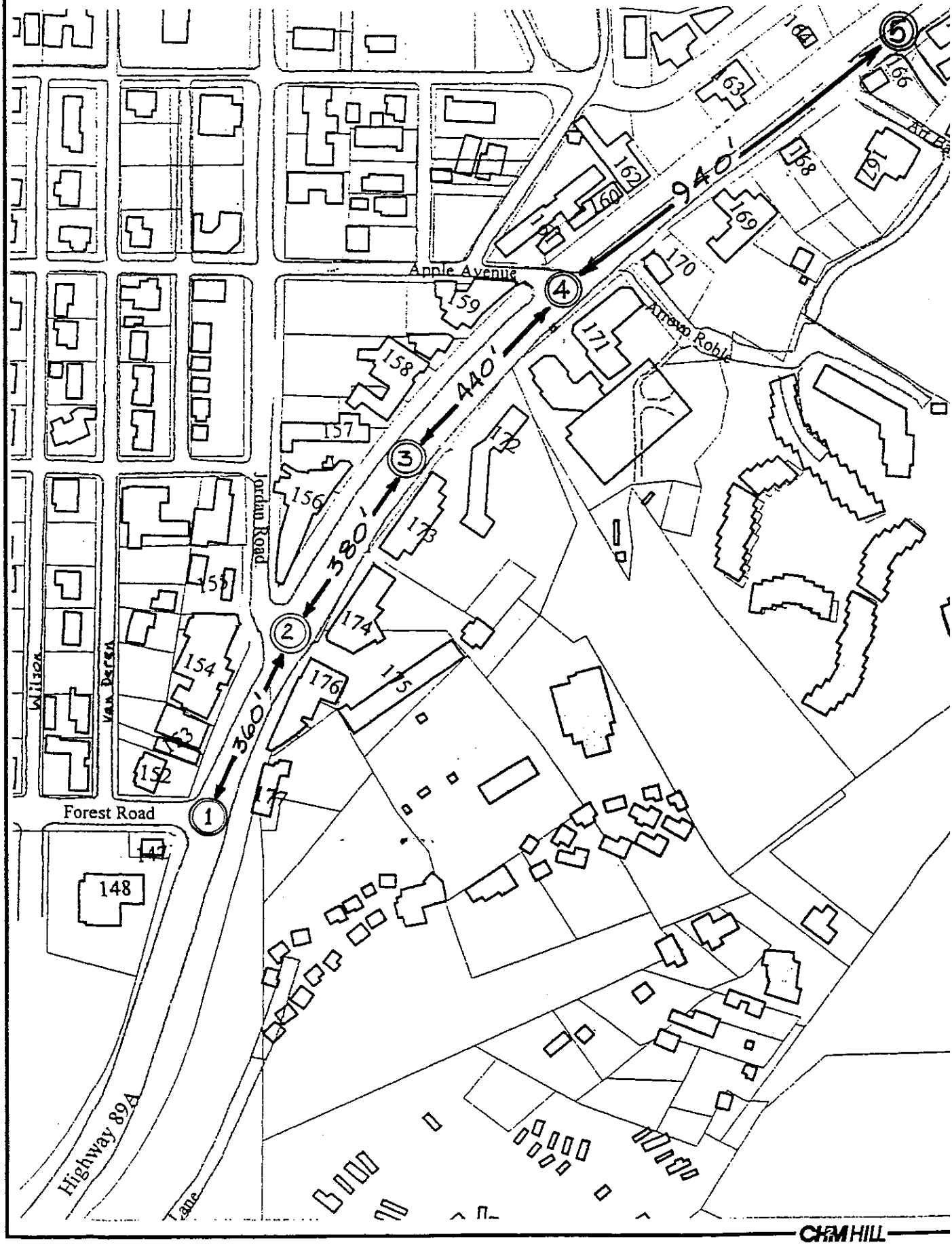
From ADOT's traffic studies at Jordan Road and Forest Road, several warrants were satisfied at each location, which justifies signals for the intersections. However, since the intersections are only 360 feet apart, signalizing one of the intersections may preclude the need for a signal at the other.

The data collected on pedestrian crossings clearly supports the need for at least one signalized crosswalk location. Whether the crossing is at mid-block or at an intersection should depend on circulation and other considerations including safety, convenience, driver expectation, and traffic progression. These considerations are addressed in the following paragraphs.

Five individual locations and two multiple-signal locations were evaluated for identifying signalized crosswalks, and are depicted in Figure 2. They are:

1. Forest Road
2. Jordan Road
3. Mid-block Crossing (between Jordan and Apple)
4. Apple Avenue
5. Art Barn Road/ Cliffs Drive
6. Jordan & Apple
7. Forest, Mid-block, & Art Barn

Figure 2 - Potential Locations for Traffic Signals



CH2M HILL

A traffic analysis was performed for the intersections using 1996 traffic volumes, and is presented in Appendix C. In particular, it estimates the number of vehicles that could be stopped at the intersection as a result of the signal.

Option 1. Forest Road Intersection

Forest Road intersects with SR 89A at the south end of the Uptown business area. It is the primary access for the Fire Station, and is the southern limit to the Uptown business area. The ADOT traffic needs study states that the Forest Road intersection satisfies three of the warrants for signalization. Operational analysis of a signalized intersection shows a LOS C for the PM peak hour (1996 traffic volumes), with an estimated maximum of 14 vehicles stopped in the northbound direction resulting in 280 feet of queue. Since there is little opportunity for disrupting the platoon of vehicles between Forest Road and the Y-Intersection (e.g., vehicles turning on and off the road), no affect on the "Y" intersection is expected.

The Uptown/Creek Area Plan Suggests that street side parking on the east side of SR 89A be eliminated with the exception of a few short-term/ parallel parking. To compensate, the City could provide alternate parking along side streets accessible from Forest Road. Van Deren and Wilson Roads are two local streets that could be converted to a one-way couplet which would allow for on-street parking. Also, there is potential for providing additional parking on parcels adjacent to the proposed "Y-Development" on the south side of Forest Road. Therefore, with traffic attributable to the "Y" Development and potential additional parking in the vicinity, Forest Road will likely see additional traffic volumes as well as turning movements at the intersection with SR 89A.

The Forest Road loop extension is not expected to be constructed within the planning window, however, there is potential for the connection to occur at some point in time. The potential construction of the Forest Road Loop provides further justification for locating a signal at Forest Road.

According to the traffic study, the number of pedestrians crossing SR 89A at Forest Road is significantly less than at Jordan Road or in the central business area. This stands to reason since the intersection is at the south end of the business area, and out of the way for most pedestrians. If Forest Road were the only location for a signalized crossing, one might expect a high number of special need pedestrians (elderly, adults with young children) to walk an extra distance to cross at that location. This would be particularly true during periods of peak traffic flows. However, having a signalized crossing at Forest Road only would be of little benefit to the majority of pedestrians, since it is roughly 750 feet south of the central business area (assuming the center of the business area is halfway between Apple Avenue and Jordan Road). Thus it is reasonable to expect that most of the pedestrians would continue to cross SR89A in the same uncontrolled fashion as they are currently doing.

If the Forest Road intersection were signalized, some modifications would be expected to improve turning radii and crosswalks, therefore the total cost of improvements is considered moderate. No additional right-of-way is expected.

Option 2. Jordan Road Intersection

Jordan Road intersects with SR 89A at an undesirable skew, approximately 360 feet north of Forest Road. From ADOT's studies, Jordan Road meets more of the warrants for a signalized

intersection than does Forest Road. Jordan is the main access to the parking areas and tour bus stops behind many of the businesses in the Uptown. Locating a central public parking facility off of Jordan was initially considered and presented in the "Uptown/ Creek Area Plan". However, it appears that less expensive parking alternatives may be available elsewhere (and accessible from Forest Road).

Jordan Road is the main collector road for residents living in the areas north of Uptown, and provides access to the several historic buildings to the north. Locating a traffic signal at this location has several merits:

- It assists in removing traffic (intending to park) before reaching the central area of Uptown, where the greatest number of pedestrian conflicts occur.
- Improves the left-turn movements onto Jordan Road, which reduces the congestion on SR 89A. Roughly 1/3 of the northbound peak hour traffic makes left-turns onto Jordan Road.
- The intersection/crosswalk is roughly 380 feet from the central business area of the Uptown, which is considered convenient for most pedestrians. If this were the only signalized crossing, a significant number of pedestrians would likely use it, in lieu of crossing at uncontrolled locations.
- Traffic signals at the Jordan Road intersection would likely preclude the need for signals at Forest Road.

Some modifications to the intersection are expected, including possible realignment of the Jordan Road approach to optimize turn movements and crosswalks. The overall cost of the improvements is considered moderate to high, depending on how extensive the realignment must be. Additional right-of-way needs would depend on the extent of the intersection modifications.

Option 3. "Uptown Mall" (Mid-Block) Crossing

SR 89A, from Jordan Road to Apple Avenue is the center of the Uptown Business Area attracting many visitors to the adjacent retail stores and restaurants. From the CH2M HILL video data, the locations where pedestrians crossed SR 89A between Jordan Road and Apple Avenue were uniformly dispersed throughout the reach. There was no definitive pattern observed. Locating a signalized crossing at the mid-block would be most convenient for a majority of pedestrians, and more widely used than any other location.

In the signal analysis, it was assumed that approximately 75% of the pedestrians would use a centralized crosswalk. This resulted in a maximum of 8 vehicles stopped at the intersection per cycle, this would produce a maximum queue of 160' in length. The queue expected for this situation would not create impacts to the adjacent intersections at Jordan Road and Apple Ave. A signal at this crossing coupled with a signal at Forest Road could be interconnected such that additional delays in the flow of traffic would be minimal with still no adverse affect to the "Y" intersection expected.

The MUTCD states that curbside parking at non-intersection locations should be prohibited for 100 feet in advance of, and 20 feet beyond the crosswalk. This will eliminate some of the

existing parking along SR 89A, but appears to be consistent with the "Uptown / Creek Area" study.

Improvements for a signalized crosswalk at the Mid-block would consist of signalization with half the number of poles and signal heads as other signalized intersections. However, considerable street enhancements would likely be needed such as islands, walkways, curb and gutter, and possibly a low wall or plantings to direct pedestrian traffic toward the crosswalk. Overall costs would likely be in the same order of magnitude as the previous two options. No additional right-of-way is expected.

Option 4. Apple Avenue Intersection

Apple Avenue intersects with SR 89A near the north end of the Uptown Area. Pedestrian traffic to and from the Sinagua Plaza appear to make up the majority of the crossings, which is a significant portion of the total crossings observed between Jordan Road and Apple Ave.

Apple Avenue, in its existing condition, consists of a fairly steep grade (roughly 6% to 8%) at the approach to the intersection. It is an undersized two lane local street less than 24-foot wide with buildings immediately adjacent to the edge of pavement (possibly encroaching on the right-of-way). No traffic volume data has been collected for this intersection, but from field observation, Apple Avenue is the primary route for tour buses making circuit runs in the Uptown Area. During the four hour videotaping of pedestrian crossings on July 20, 1996, there were 28 buses observed turning onto Apple Avenue. The buses turn onto Apple Avenue for access to the parking area on Jordan Road, circulating in a counter-clockwise pattern (heading up-grade on Apple Avenue).

Apple Avenue could play an important role in the circulation of transit and vehicle access to public parking. The City may want to consider improving the roadway beyond just the intersection, with the intent to include Apple Avenue as part of a 'bigger picture' circulation scheme. However, there would likely be significant right-of-way issues associated with such improvements.

Signalizing Apple Avenue could require other intersection/street improvements such as turning radii, left-turn lane, and curb, gutter, and sidewalk. Costs are expected to be high particularly for improvements along Apple Avenue if the acquisition of right-of-way is necessary. This intersection requires a traffic warrant study in conjunction with a public parking plan to determine how signalization (and pedestrian crossing) will benefit the flow of traffic.

Option 5. Cliffs Drive / Art Barn Road Intersection

The proposed Cliffs project is a major hotel/retail development planned near Art Barn Road on both sides of SR 89A, north of the central business area. With an estimated 700 employees, the development is expected to add nearly 10,000 person trips per day to the main roadway, which would invariably require a traffic signal at the proposed Cliffs Drive intersection near the Art Barn Road intersection (ADOT - Traffic).

Having a signal at the north end of town will provide motorists advance warning of a developed area where pedestrians can be expected. Signalizing the Cliffs Drive intersection would also likely create sufficient gaps to allow for left turn movements at Apple Avenue, just 940 feet to the south.

It is anticipated that the Cliffs development project would require some rather extensive roadway improvements on SR 89A, of which the signalization would be part.

Option 6. Two Signals - Jordan / Apple

An option to consider is the location of signals at both Jordan Road and Apple Avenue. These streets provide access to the tour-bus and parking areas along Jordan Road, as well as access to the shops, historic, and residential areas along the north Jordan Road corridor. Having signalized intersections at these locations will assist motorists toward the parking facilities, while keeping uniform platoons moving through the Uptown Area. They offer some advance warning of a controlled traffic environment to motorists entering the Uptown Area which lends itself to a safer condition for pedestrians. There is roughly 820 feet between Jordan Road and Apple Avenue which is a comfortable distance for providing sequenced traffic signals while being conveniently located for pedestrian crossings. For the pedestrian, they are conveniently situated where the majority of crossings presently take place. Improvements at both Jordan and Apple, however, would be considered significantly more expensive to construct by comparison to Forest or the Mid-block location.

Option 7. Three Signals - Forest / Mid-block / Cliffs Drive

Another option to consider is the placement of signals at the Forest Road intersection, the Mid-block location, and at Cliffs Drive. Here, the benefits of the traffic signals at Forest Road are combined with the convenience of the Mid-block crosswalk. Northbound vehicles can be directed to parking facilities before entering the central business area, thereby minimizing conflict with the pedestrians. Southbound vehicles enter a controlled right-of-way, and are alerted to the presence of pedestrians in advance of the central business area.

As shown in Figure 2, Forest Road is approximately 740 feet from the mid-block crosswalk, which in turn, is 1,380 feet from Cliffs Drive. This spacing offers good distance for signals, maintaining continuity in traffic flow.

Traffic signals at the Mid-block location could be demand actuated (Ped button) with a timed cycle during peak hours. This could allow for sufficient breaks in the traffic stream for left turn movements at Jordan Road.

Recommendations

Signals at Forest Road, Mid-block crosswalk, and Cliffs Drive provides the most benefit for improving the traffic and pedestrian conditions in the Uptown Area. It can be implemented in phases beginning with the Mid-block crosswalk, which offers an immediate solution to the uncontrolled pedestrian crossings, as well as additional relief for left-turn movements at Jordan Road during peak hours. The Forest Road signal should also be installed to control the flow of traffic from the south. This will become increasingly more apparent when additional public parking is provided off of SR 89A. The Cliffs Drive signal, least important to pedestrian movements at this time, would then be implemented by the traffic demand associated with the proposed Cliffs development project.

An intersection and arterial analysis was performed for this option, and is presented in Appendix D. The analysis used future traffic volumes (year 2010) with movements prorated based on ADOT's traffic data. It determined the Level Of Service for the intersections as well as the arterial roadway. The analysis shows a Level Of Service F at the Forest Road intersection,

with LOS A at the mid-block, and LOS C at Art Barn Road. The failure at Forest Road is due to the future volume of traffic being greater than the capacity of the road (v/c=1.19). This stands to reason since SR 89A transitions from four lanes at the Y-intersection to two lanes before Forest Road.

Future traffic volumes predicted by the Sedona Traffic Model are based on the assumption of nearly total build out (89%) by the year 2010. In the Uptown Area this includes the major planned developments of the Cliffs project as well as the "Y" development. If traffic increases as predicted, a LOS F on SR 89A through the Uptown Area is bound to occur.

The typical solution to the predicted traffic congestion in the Uptown Area would be to add additional lanes along this section of SR89A. Creating a four lane highway through Uptown would impact existing parking, access, and could change the overall character of this section of Sedona. However, this is not the only solution that should be considered, a pro-active approach to transportation solutions from the stakeholders in the Uptown Area (residents, business owners, employees) could initiate alternative solutions. These alternative solutions could include concentrated parking areas, transit shuttles, and bypass routes that may avoid the requirement for additional through lanes along SR89A. The stakeholders should agree to a unified vision for the Uptown Area and determine the appropriate transportation approach for accomplishing that vision.

Uptown Area - Parking

Provision for additional parking facilities off of SR 89A will mitigate both the traffic and parking problems in the Uptown Area. This can be accomplished through use of either a central parking facility or several decentralized parking areas. To be effective, however, the parking facilities must be properly signed and convenient access provided.

From the Origin - Destination Study, it was demonstrated that the majority of parking in the Uptown Area is long term, however, short term parking is essential for the businesses, and a portion of the existing parking should be provided either within the right-of-way, or behind the businesses. A significant amount of the parking within the SR 89A right-of-way, although desirable, should be eliminated and substituted with alternative parking lots off the main roadway or located outside of the Uptown Area. Parking areas outside the Uptown Area may need to be supported by a transit shuttle. The parking plan for the Uptown Area should match the vision conceived by the stakeholders within the Uptown area and a detailed implementation plan derived to ensure the appropriate parking is maintained.

An evaluation of parking for the Uptown Area should be conducted in detail, especially if land acquisition or capital improvement costs are anticipated. The following should be considered in such evaluation:

1. Transit routes and transit stop locations will play a key role in the number and convenience of parking options.
2. On street parking on SR 89A is limited, but still important to the short-term parking needs.
3. Parking on side streets (one-way couplets) offers limited additional spaces, but could be effective for near term mitigation.

4. Utilization of private lots for general public use (e.g. adjacent to proposed developments) and shared lots between businesses would optimize available space in the Uptown Area.

Access Control and Traffic Calming Features

The operational efficiency of SR 89A and SR179 through the City of Sedona has been bogged down by the increased traffic and turning movements to and from properties fronting the two main corridors. Concentrating access to these properties through shared driveways, and raised medians will result in fewer turning conflicts and improved operation. Raised medians have application on arterial streets where it is desirable to regulate left-turn movements, providing a more predictable flow of traffic. They are also frequently used where median landscaping is desirable, but should be wide enough to accommodate maintenance. In many cases, however, medians will force a right-in/right-out situation, making access to and from some properties less convenient.

Proposed Access Control Measures in the Uptown Area

The "Uptown / Creek Area" study proposes medians along SR 89A through the Uptown Area. Medians are a desirable feature of arterial streets and should be provided where space permits. They are an effective means of calming traffic by reducing the driver's options and controlling turning movements. As a result, however, more turning movements can be expected at the first available opportunity, including U-turns if allowed. This may be acceptable as long as the street and traffic conditions can accommodate these movements. Under some conditions it is better to permit mid-block turns, than to require such turns at intersections or travel around the block. However, if a mid-block pedestrian crossing is provided between Jordan Road and Apple Avenue, U-turns should not be permitted. Placing continuous medians between Jordan Road and Apple Avenue is desirable.

Medians can be incorporated into an overall landscape plan with plantings, colored materials and designs. They can offer significant visual impact from screening the drivers view of the opposite side of the street or opposing traffic, to calling attention to specific locations using landscape elements, lighting, or shapes. Headlight glare can be significantly reduced depending on the median width. In addition, medians of sufficient width can be a safe refuge for individuals stranded in the midst of crossing the SR 89A. Pedestrians are required to watch only one direction of traffic at a time, and are given a welcome break at the median.

A median from Forest Road to Jordan Road should be provided. A width of 4 feet (minimum) should be considered due to a left-turn bay at Jordan. From Jordan Road to Apple Avenue, medians should be 16 feet minimum width to accommodate pedestrian crossings, and to allow for a left-turn bay at Apple Avenue. Medians north of Apple Avenue should be evaluated as part of the roadway improvements and signalization in conjunction with the proposed Cliffs development project.

Access Control Measures and Traffic Calming Features - SR179 & West Sedona

This section addresses the access control and traffic calming features along SR 89A and SR179 as presented in both the *Uptown / Creek Area Study* and the *West Sedona Commercial Corridor Study* (WSCCS). The discussions address raised medians, elimination of direct access onto the highways, and placement of traffic signals. It is the result of our review of the documents as well as a site investigation performed on July 17, 1996, by CH2M HILL staff.

The purpose of the site investigation was to identify where raised medians can be placed along SR179 north of Canyon Drive, and along SR 89A from the Y-intersection to Pinon Drive in West Sedona. Its focus is on reasonable access for properties fronting the highway corridors while minimizing the number of direct access points. To accomplish this, adjustments to access are proposed for several properties including; relocating drives to the side streets, sharing common access drives, and modifying parking areas.

The recommendations presented in the following paragraphs are conceptual in nature, and should be reviewed with individual property owners prior to implementation. It is suggested that the reader refer to Figures 3 through 5 to assist in understanding the discussion and recommendations made.

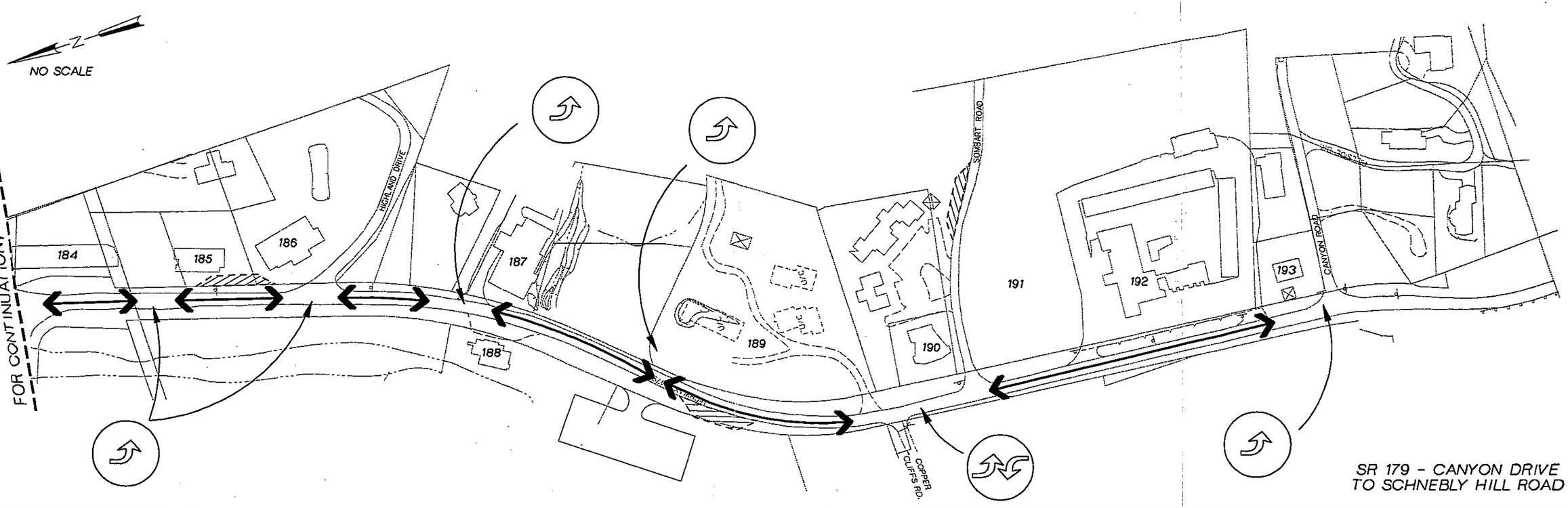
SR179 - Canyon Drive to the Y-Intersection

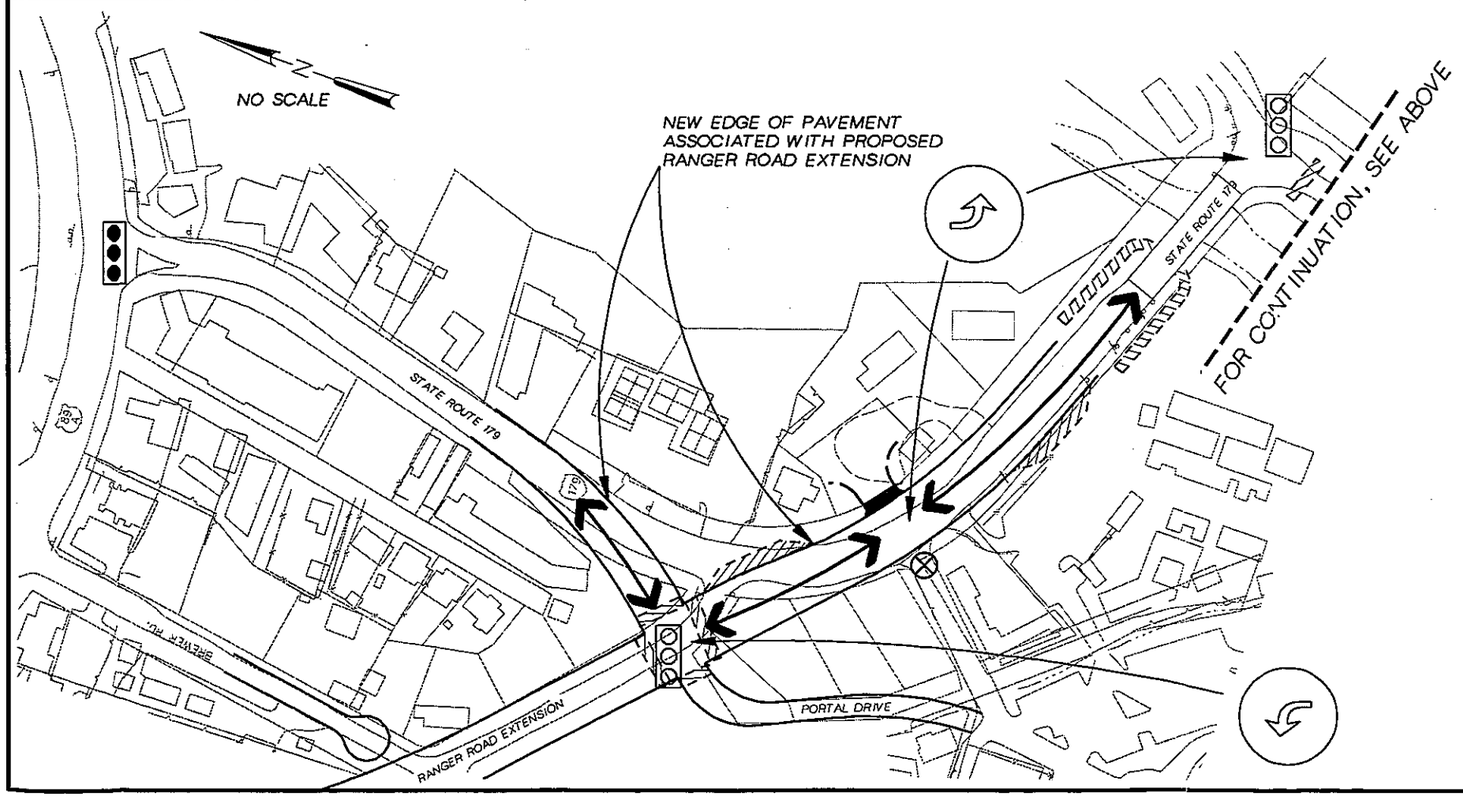
Canyon Drive to Schnebly Hill Road

The Uptown / Creek Plan proposes that Sombart Road be realigned with Copper Cliffs Road to make a 4-point intersection, and that the intersection be signalized. It is desirable to remove the offset between these intersections and create one 4-point location to accommodate the turning movements. The impacts required to accomplish this task do not seem to justify the benefits that would be realized at this time. After implementation of a raised median through this section of SR 179 is completed the situation should be re-evaluated to determine if changes in traffic patterns would warrant the realignment of Sombart Road. If landuse changes occur in the vicinity of this intersection, then the operation of these offset intersections should be closely scrutinized to determine if development changes impact the intersection to necessitate realignment.

The *Traffic Operational Analysis Report* for the *SR179 Design Concept Study* (BRW, 1995) evaluated signals at the SR 179 and Schnebly Hill Road intersection. There is no warrant for signalizing the intersection using current (year 1995) traffic data. However, future volumes (year 2017) suggest a signalized intersection to avoid LOS F conditions. Therefore, a traffic signal is proposed at Schnebly Hill Road, but will require confirmation through a traffic study at a later time.

The *SR179 Design Concept Study* (BRW, 1995) also recommends improvements to the Oak Creek Bridge. Two alternatives are considered; widening the existing structure, and constructing a new bridge on a new alignment. The widening option would accommodate four lanes of traffic. Alternatively, a new structure would be placed on a curve, offering better driver comfort and higher speed. This alternative is more desirable with respect to improving traffic flow, but is much more costly due to additional right-of-way needs as well as a new road /





LEGEND

- PROPOSED MEDIAN LIMITS
- PROPOSED TROLLEY STOP
- PROPOSED DRIVEWAY INSTALLATION OR IMPROVEMENT
- PROPOSED PEDESTRIAN CROSSING
- PROPOSED INTERCONNECTION OR OTHER IMPROVEMENT
- ROAD CLOSURE
- MEDIAN OPENING PROVIDING LEFT TURN IN BOTH DIRECTIONS
- MEDIAN OPENING AND HIGHWAY WIDENING TO ACCOMODATE U-TURNS
- MEDIAN OPENING PROVIDING LEFT TURN IN ONE DIRECTION
- EXISTING TRAFFIC SIGNALS
- PROPOSED TRAFFIC SIGNALS

* CONNECTION NOT REQUIRED TO PROVIDE ACCESS ALONG SR89A. HOWEVER, ENHANCED NEIGHBORHOOD ACCESS WOULD BE PROVIDED.

FIGURE 3

SR 179 - SCHNEBLY HILL ROAD
TO RANGER ROAD EXTENSION

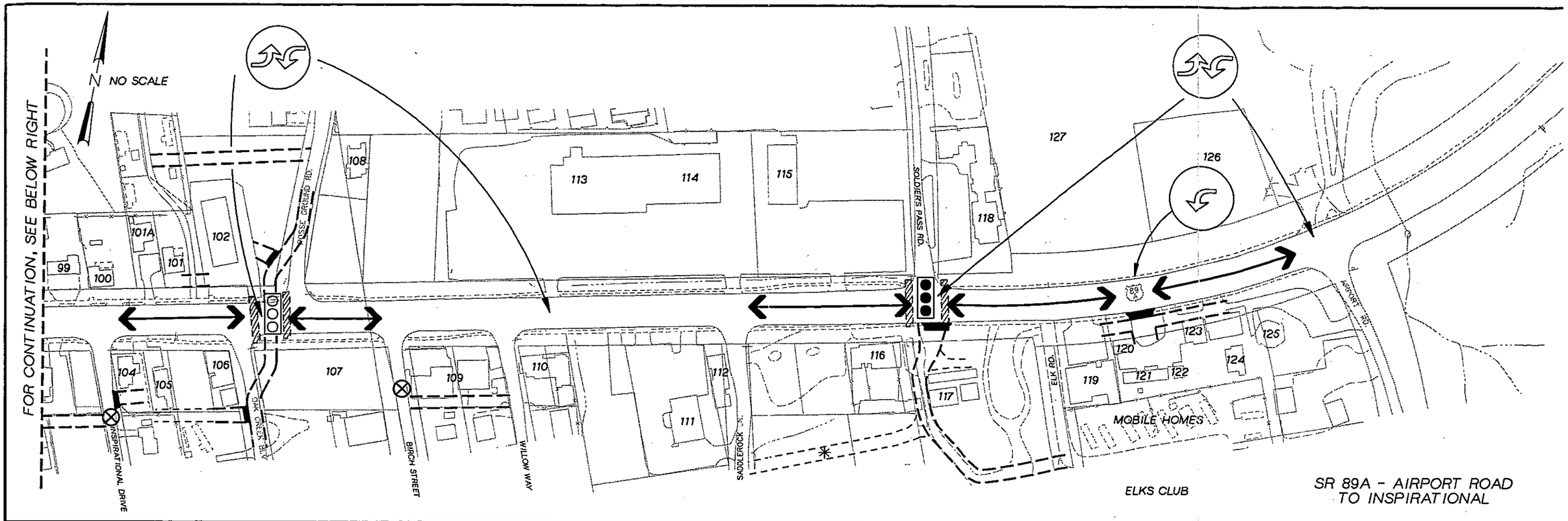


FIGURE 4

SR 89A - INSPIRATIONAL
TO GOODROW

PLOT DATE: FILE NAME:

FOR CONTINUATION, SEE BELOW RIGHT

NO SCALE

N

CANTRIBLE ST.

MELODY LN.

HARMONY DR.

ANDANTE RD.

TRAILER COURT

RIGBY RD.

TANK

HARDEY RD.

McDONALD'S

SAFEWAY

SHELBY DR.

BABBIT'S HOME CENTER

SEDONA BUSINESS PARK

SR 89A - SHELBY STREET TO THUNDERBIRD DRIVE

SINAGUA AVE.

SOUTHWEST DR.

TORTILLA DR.

ROADRUNNER DR.

DRY CREEK RD.

CHALET DR. EAST

ARROYO PINON (NEW)

ARROYO PINON (OLD)

PINON DR.

DEER TRAIL DR.

E. 232,000

REALIGNMENT ALREADY COMPLETED

FIGURE 5

SR 89A - THUNDERBIRD DRIVE TO PINON DRIVE

bridge reconstruction. The recommendations described in this section would be compatible with either of the above scenarios.

A continuous raised median is proposed through this section, with isolated locations where left-turn access would be provided. No raised median would be provided from Sombart Road to Copper Cliffs Road. Openings in the median would be provided for left-turn maneuvers at Sombart Road, Copper Cliffs Road, at properties 187 and 188, Highland Drive, at properties 184 and 185, and at Schnebly Hill Road.

The Uptown / Creek Plan shows five pedestrian crossing locations along SR 179. Whether crosswalks are warranted at any or all of these locations requires further analysis of the pedestrian movements, but at this time, there does not appear to be adequate justification. In either case, unsignalized crosswalks should not be considered. Pedestrian crossings are recommended at Schnebly Hill Road and Ranger Road once traffic signals are installed.

In addition, the Uptown / Creek Plan shows three transit stop locations along SR179. The transit stop locations are located near existing parking lots, so they could be used by visitors choosing to park at remote locations. Specific comments to these transit stop locations are as follows:

1. The transit stop near Properties 185/186 should be either accommodated with a crosswalk at Schnebly Hill Road and should have a complimentary transit stop for access to shops at Portal Drive and SR 179.
2. The transit stop recommended in front of Property 188 should be located further south, to the recently approved parking area (for B&B).
3. The transit turnaround (assuming end of transit route) should be provided along Sombart Road. Trolleys should be able to turn onto Sombart Road and into either the Comfort Inn (Property 191) or King's Ransom (Property 192) parking area to turn around.

Impacts and Mitigation

Property 193 would have full access since an existing access point is located on Canyon Road.

Access drives for properties 191 and 192 would be limited to right-in/right-out (RIRO), however these properties currently have interconnections and access to Sombart Road, therefore full access is provided.

Property 190 would have full access since an existing access point is located on Sombart Road.

Property 189 would have full access to its access drive opposite Copper Cliffs Road.

No impacts to properties 187 and 188.

Access drives for property 186 would be limited to RIRO, however this property has a parking area off of Highland Ave.

No impacts to properties 184 and 185.

Schnebly Hill Road to Ranger Road

With the proposed extension of Ranger Road and the realignment of Portal Drive to be opposite of the connection to SR 89A, a raised median can be incorporated from the Portal Drive intersection to the Oak Creek structure. One left-turn opening would be provided to the

properties on the north side of the roadway, and their access drives would have to be combined.

Ranger Road to the Y-Intersection

The existing 4-lane roadway from Ranger Road to SR 89A would not have to be widened if Ranger Road were extended as proposed in Technical Memorandum #3. No raised medians are recommended in this reach except for a median to channelize the left-turns at the Ranger Road intersection. Traffic signals would be required at the SR 179 Ranger Road extension, and interconnected with the signals at the Y-intersection to provide effective progression of traffic.

SR 89A - West Sedona

Airport Road to Soldiers Pass Road

The WSCCS does not recommend continuous raised medians through this area, however they do recommend select placement of medians to channelize the left-turn movements at the signalized intersections.

Left-turns should be provided at Airport Road, Soldiers Pass Road, and a location halfway between to allow left-turns to and from the south side of the highway.

The WSCCS recommends an extension of Brims Mesa Drive from Airport Road to Saddle Rock Lane. This connection may increase neighborhood access, however it would be set back from SR 89A too far to provide back access to commercial properties. The location of the Elks Club and a cemetery would make a back access connection difficult to implement.

Impacts and Mitigation

Access drive for property 125 would be limited to RIRO, however this property has an access drive off of Airport Road.

Properties 119 through 125 either have existing interconnections between parking areas, or such interconnections could be easily constructed. One central access location could be created to provide full access onto SR 89A.

Elk Road would be limited to RIRO. It is recommended that a new roadway connection be provided to line up opposite Soldiers Pass Road, which will provide full access to the mobile home area south of SR 89A.

Soldiers Pass Road to Northview Road

The WSCCS does not recommend continuous raised median through this area. Medians are recommended at signalized intersections to channelize the left-turn movements. This approach is possible with signals located at Soldiers Pass, Posse Grounds, and Northview Roads. Raised medians would be located at the following locations;

- Soldiers Pass Road to Saddle Rock Lane
- Birch Street to Posse Ground Road
- Posse Ground Road to Inspirational Drive
- View Street to Northview Road

The neighborhoods south of SR 89A have access to the highway at several intersections including, Saddle Rock, Willow, Birch, Oak Creek, Inspirational, View, and Northview. The WSCCS recommends that access be eliminated to SR 89A for all of the neighborhood roads except Saddle Rock, Oak Creek and Northview. Elimination of minor intersections is an appropriate way to eliminate left turn conflicts and improve traffic operations along the SR 89A corridor. The WSCCS further recommends a continuous roadway connection from Saddle Rock to Northview, approximately one block south of SR 89A. Based on our review, the entire connection may be difficult to implement in the immediate future, and would likely need to be phased in over time.

The connection between Saddle Rock Lane and Willow Way is not recommended at this time, it is not required for commercial access because an open median is provided, and full access could be provided to both Saddle Rock Lane and Willow Way. A backside access type connection is recommended between Birch Street and Willow Way behind the existing business on SR 89A. A neighborhood connection is recommended between Birch Street and Oak Creek Boulevard some distance south of parcel 107 (exact alignment was not determined). Another connection is recommended from Inspirational Drive to Northview Road. These connections will allow for the following intersections to be closed along SR 89A;

- Birch Street
- Inspirational Drive
- View Street

The remaining links could be added as funding is available or as additional need is shown to warrant a continuous connection from Saddle Rock to Northview.

A signalized intersection is proposed at the realigned Posse Ground Road and Oak Creek Blvd. intersection. If it is interconnected with other signals on SR 89A, it should improve the flow of traffic at that location.

Impacts and Mitigation

Access drives for properties 101 and 102 would be limited to RIRO, however these properties have an existing interconnection between parking areas, and a connection to a realigned Posse Ground Road could be implemented to provide these properties with full access.

Property 106 would be limited to RIRO, however access could be created to Oak Creek Drive at the rear of this property.

Properties 104 and 105 could combine their access, and have full access out the abandoned Inspirational intersection.

Property 101A would be limited to RIRO unless an agreement with an adjacent property owner could be achieved to interconnect these parking areas.

There would be no impacts to properties 98, 99, 100, and 103.

Properties 93 and 94 would be limited to RIRO, however the interconnection roadway between View Street and Northview Road would provide backside access.

Properties 96, and 97 would be limited to RIRO, however an opportunity exists to interconnect the backside of these properties with 95, giving access to Mountain Shadows Drive.

Access drive to property 95 would be limited to RIRO. Existing access is located on Mountain Shadows.

Northview Road to Coffee Pot Road

The WSCCS recommends that a continuous raised median begin at Northview and extend to the western limits of the City, providing left-turning movements at key locations. The section of SR 89A from Northview to Andante is predicted to have higher traffic volumes than anywhere else in the city, and therefore should include traffic calming features such as raised medians. West of Andante, development is expected to continue. Installation of raised medians through this reach will optimize traffic operations before access drives can be established.

Recommendations from Northview to Coffee Pot include a continuous median with left-turns allowed at Northview, Kallof/Payne, and Coffee Pot Road.

Impacts and Mitigation

Access to/from the Basha's shopping center will not be impacted. Its primary access drive on SR 89A is currently limited to RIRO, but additional access is provided from Coffee Pot Road.

The access drive for property 88 would be limited to RIRO, however an existing access point is located on Kallof Place, providing full access to SR 89A.

Properties 89 and 90 would be limited to RIRO, but an opportunity exists to provide a backside interconnection between these properties and property 88 to Kallof Place.

Access drives to properties 86 and 87 would be limited to RIRO, however there are existing interconnections between these properties, and Payne Place.

Coffee Pot Road to Shelby Drive

A continuous raised median is recommended through this section. Openings for left-turns will be provided at Coffee Pot, entrance to the Harkins Theater, Goodrow Ave, and Shelby Drive.

Impacts and Mitigation

Property 81 would have no impact since all access to this property is currently from Coffee Pot Road.

Property 80 would be limited to RIRO. However the opportunity exists to combine the parking for property 80 with property 81 to provide access to Coffee Pot Road.

The median opening for the Harkins Theater entrance, would also provide left-turn access to an entrance drive on the north side of the highway. Properties 75-79 either have existing parking area interconnections, or can easily be interconnected. These properties would have full access at a common driveway.

Property 74 would be limited to RIRO. However, the opportunity exists to connect the parking area of this property to Goodrow Ave., thus providing full access.

Properties 63 and 64 would be limited to RIRO. However these properties currently have access locations on Shelby Drive, providing full access.

Properties 65-70 have existing interconnections between parking lots. Full access would be provided to these properties at Sunset Drive or at the entrance drive to Harkins Theater.

Shelby Drive to Andante Road

A continuous raised median is recommended through this section. Openings for left-turns will be provided at Shelby, Maddle, and Andante. The Stutz Bearcat intersection will be limited to RIRO, and because of this it is recommended to widen SR 89A at Andante and Madole Road to provide U-turn maneuvers.

A signalized intersection is proposed at Andante Road. If it is interconnected with other signals on SR 89A, it should improve the flow of traffic at that location.

Impacts and Mitigation

The access drive near McDonald's would be limited to RIRO. There are existing parking interconnections within the Safeway Shopping area which provides full access to SR 89A.

Properties 58 and 59 would be limited to RIRO. A backside drive could provide access to Shelby Drive, however this drive would have to be constructed through the Sedona Business Park.

Full access would be maintained to Babbit's Home Center in combination with the median opening to Madole Road.

Properties 54-56 would be limited to RIRO. New development in this area will implement a deceleration lane at Madole Road, which will affect parking within the existing right-of-way (property 56). The provision for U-turns at Madole and Andante would also allow access to these properties.

The trailer court that currently accesses SR 89A from Rigby Road, would be limited to RIRO. However a dirt road exists that connects Rigby Road to Madole Road, where full access is provided. This dirt road could be upgraded and become a city street. An additional access drive could be considered into the Safeway Complex in combination with this street improvement.

Properties 49-52 would be limited to RIRO. The provisions for U-turns at Madole and Andante would mitigate the restricted movements. Interconnections between the parking areas is possible and would also allow for full access to Andante Drive.

Andante Drive to Southwest Drive

A continuous raised median is recommended through this section. Openings would be provided for left-turn maneuvers at Andante Drive, Thunderbird Drive, at properties 42 and 44, and Southwest Drive. Since the intersection at Harmony Lane would be limited to RIRO, it is recommended to widen SR 89A at Andante and Thunderbird Road to allow for U-turn maneuvers.

Impacts and Mitigation

Properties 44 and 45 have an existing interconnection between their parking areas and access to Andante, and a median opening is included to provide full access to these properties.

Properties 35, 36, and 43 would be limited to RIRO. The provision for U-turns at Thunderbird and Andante would provide access to these properties. Properties 36 and 43 currently have access to Harmony Drive, which connects back to Andante Drive via Melody Lane.

Property 34 is located opposite of the Thunderbird Intersection. If the driveway layout of this property is revised, full access could be provided.

Property 33 would be limited to RIRO. In the future if development occurs in the empty lot in the northeast quadrant of SR 89A and Southwest Drive, a parking interconnection could be provided to allow access for property 33 to Southwest Drive.

Properties 30 and 31 would be limited to RIRO. However a backside interconnection could be implemented to provide access to Thunderbird Road, where full access is provided.

There would be no impacts to property 32 which currently is accessed from Thunderbird Drive.

Properties 37-42 currently have parking area interconnections, and property 37 has existing access to Thunderbird Road. The median opening at property 42 and access to Thunderbird Road allows for full access to these properties.

Property 46 would be limited to RIRO, however an interconnection with property 47 could allow traffic access to the signal at Andante.

Southwest Drive to Dry Creek Road

A continuous raised median is recommended in this section except for a section from Roadrunner to property 13. A continuous median would be desirable from Dry Creek Road to Roadrunner, however, the current landuse is more compatible with an open median from Roadrunner to property 13. If future development were to consolidate properties and access locations in the future, a continuous median should be implemented for this section of SR89A. Openings in the median would allow left-turn maneuvers at Southwest Drive, Deer Trail Drive, Roadrunner Road, and Dry Creek Road. The intersection at Tortilla Drive would be limited to RIRO.

A signalized intersection is proposed at Dry Creek Road. If it is interconnected with other signals on SR 89A, it should improve the flow of traffic at that location.

Impacts and Mitigation

Property 19A would be limited to RIRO.

Properties 19-21 currently have interconnections between their parking areas, but their driveways are limited to RIRO. An existing connection exists from these properties to Sinagua Ave, where traffic could access Southwest Drive.

Properties 22 and 23 would be limited to RIRO. However, the opportunity exists to interconnect the parking areas of properties 19-23 and form a common driveway opposite of Deer Trail. This would provide full access to all of these properties, in addition to the rear exit to Sinagua Ave.

Property 25 would be limited to RIRO, unless an interconnection were made with property 26, which has full access by way of Southwest Drive.

Properties 24, 27 and 28 would be limited to RIRO. However, these properties are currently interconnected, and property 24 has existing access to Deer Trail. This situation allows for full access to these properties.

Property 29 would be limited to RIRO, unless an interconnection with property 28 were provided, giving full access as described above.

The main entrance drive to property 18 would be limited to RIRO. However this property currently has access to Deer Trail, where full access would be provided.

Properties 15-17 have parking area interconnections. These properties are opposite of Roadrunner Road, and full access could be provided to the driveway opposite of Roadrunner.

Access to properties 13 and 14 would not be modified.

The access drive for property 12 would be limited to RIRO, access to relocated Arroyo Pinon Drive is provided giving full access through the Dry Creek intersection.

Properties 7-11 would be limited to RIRO. Parking interconnections should be considered between these properties and a central driveway created across from property 13.

West of Dry Creek Road

The continuous raised median is recommended to continue along SR 89A to the point where the highway becomes a four lane divided facility, as planned by ADOT. Future development along this section of the corridor should establish access plans that are consistent with the recommendations of the WSCCS. Openings for left-turns should be provided at approximate one-quarter mile intervals. The existing intersection at Pinon Drive should be realigned to line up opposite of Calle de Este Road, and full access provided at this location.

Impacts and Mitigation

Property 12A is currently under construction, but access will be provided to Arroyo Pinon. This will provide the property full access after the implementation of the raised median.

Property 6 would be limited to RIRO. An interconnection could be created with property 12A, giving this property access to Arroyo Pinon.

Property 5 would be limited to RIRO. With the realignment of Pinon Drive, access could be constructed to provide full access.

Property 3 would be limited to RIRO. However an interconnection could be provided with property 4, obtaining full access at Dry Creek Road.

Evaluation of Transit Stop Locations

The general location and number of bus stops in the Uptown Area is largely dictated by patronage, transit system operation, land-use patterns, and route determination. There are however certain factors which influence the specific locations such as accessibility to patrons, and operational considerations of the roadway. To that extent, the following comments are made to the public transit stop locations shown in the "Sedona Uptown / Creek Area" study:

It is anticipated that a transit route to the Uptown Area would primarily run along SR 89A from the Y-intersection to the north end of the business area. Buses could turn around at Cliffs Drive/Art Barn Road, or loop onto Apple Avenue and Jordan Road. Stops along the route

would be at significant retail destinations and parking, but the number of stops kept to a minimum to be effective. Numerous stops cause time delays, and traffic conflicts making the transit system unattractive to ridership. In the Uptown Area, it is desirable to have not more than five stops (seven maximum) to be effective given the size of the business area, and destination/parking locations. Figure 6 shows recommended transit stop locations in the Uptown Area.

Bus stops are usually located in the immediate vicinity of intersections, except where cross streets are widely spaced. With a mid-block crosswalk between Jordan Road and Apple Avenue, a bus stop at mid-block would be appropriate. Mid-block stops are generally not suitable on streets where parking is permitted. However, if a mid-block crosswalk is provided, the stop location would have as many of the same advantages as a far-side stop location.

Bus stops located at intersections may be located on either the far-side (exit) or the near-side (entering), and should be examined on a case-by-case basis. However, the merits of far-side locations typically outweigh those of near-side stops. Far-side bus stops are advantageous because:

- They minimize conflicts with other buses which may be turning in either direction.
- They accommodate other vehicle right turns; particularly where turning movements are heavy from the main roadway.
- Sight distance favors far-side stops; approaching drivers can see movements from the cross street.
- Far-side stops don't block signals.
- Drivers turning at a crossroad do not encounter the hazards associated with the bus while loading.

Where buses turn left onto a crossroad, bus stops should be located at least one block prior to the intersection. This allows the bus to safely cross the required lanes of traffic on its approach to the intersection.

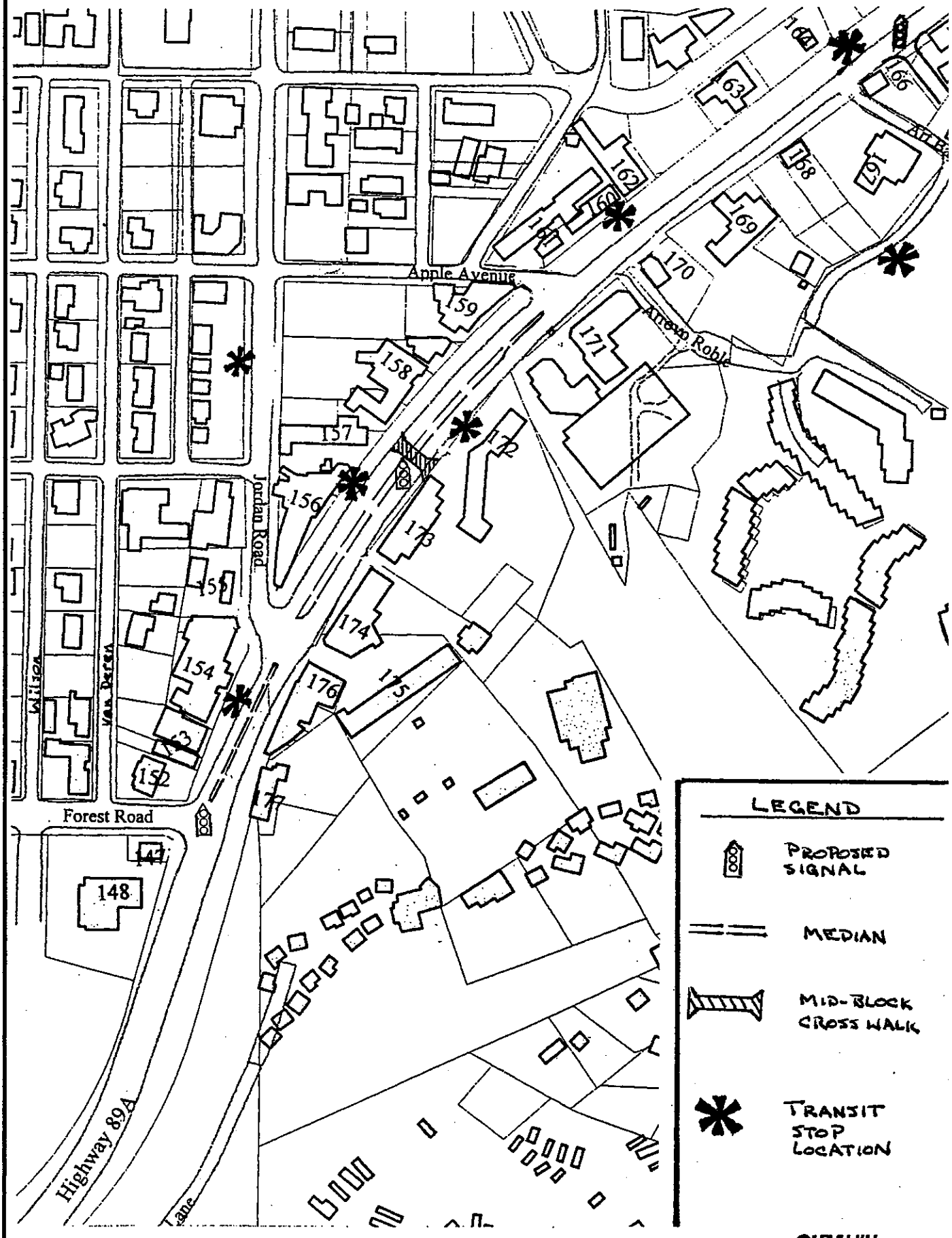
Based on the above discussions, the potential transit stop locations are depicted in Figure 6, and listed as follows:

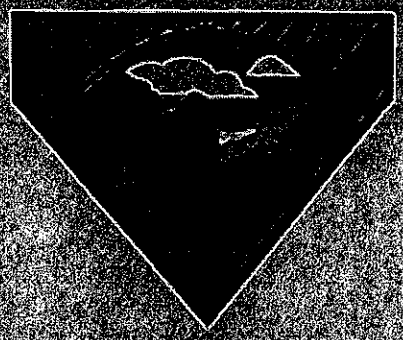
1. Northbound SR 89A, at the far side of the Mid-block crosswalk.
2. On Art Barn within the Cliffs development for access to retail and parking.
3. Southbound SR89A, across from the Proposed Cliffs development
4. Recommended location on southbound SR 89A near the Matterhorn Lodge. This would depend on ridership.
5. Jordan Road parking area behind Sacajawea Plaza, or, as an alternate, on southbound SR 89A at the far side of the Mid-block crosswalk.
6. Southbound SR 89A at the far side of the Jordan Road intersection.

Conclusion

The "Uptown/Creek Area" and the "West Sedona Commercial Corridor" studies offer practical solutions to the calming of traffic through Sedona. The proposed measures are reasonable and can be supported by engineering analysis within the context of the discussions and recommendations presented herein.

Figure 6 - Recommended Transit Stop Locations





Sedona Highway Corridor Assessment

Technical Memorandum #5

Implementation Plan for Circulation System Impovements

Prepared for

The City of Sedona

Prepared by

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December 1996

Sedona Highway Corridor Assessment Technical Memorandum #5 - Implementation Plan for Circulation System Improvements

This technical memorandum addresses the priorities and strategies for implementing the recommended circulation system improvements. Engineering evaluations of certain roadway enhancements have been proposed in Technical Memorandums # 3 and #4. These engineering evaluations were geared toward improving circulation along SR89A and SR179 throughout Sedona. In general, the recommendations made were:

- Development of the Ranger Road corridor from SR179A to SR89A (west of the Y-intersection.
- Elimination of certain access drives and installation of raised medians along SR89A and SR179.
- Signalized intersections in the Uptown Area at SR89A and Forest Rd., and at SR89A and Cliffs Drive. In addition, a pedestrian crossing is recommended at the Uptown Mall (Mid-block).
- Inclusion of Transit Stops at various locations on SR89A and SR179 as part of the Uptown Area improvements.

Each of the recommended improvements were further broken into separate, identifiable component projects, which could be considered "stand alone" projects. In other words, they could be independently evaluated, scheduled, funded, and constructed over time, and provided incremental improvement to the traffic conditions upon completion. Through this approach, the City will have the flexibility to schedule projects as funds become available and as public approval is achieved.

The projects were evaluated with respect to a number of factors:

1. Prerequisite projects
2. Improvements to traffic
3. Safety
4. Right-of-Way needs
5. Physical and developmental constraints
6. Environmental considerations
7. Timeframes
8. Agency agreements (joint funding, approvals, etc.)

A cost-to-benefit ratio was then developed by applying the above factors to the project cost. This is used to determine a priority ranking for the component projects, and is correlated to their completion, since that is when benefits are realized.

Finally, an implementation schedule was developed based on the priority of the projects and an assumed annual expenditure. This schedule depicts how long certain projects may take compared to others, and suggests what should be implemented first in order to realize the most benefit in the shortest amount of time.

Recommended Improvements

The recommended improvements are summarized in the following paragraphs with specific discussion regarding their design/construction phasing. These improvements are discussed in further detail in Technical Memorandums 3 and 4.

Ranger Road Corridor

The Ranger Road Extension provides a bypass around the "Y" intersection, thereby reducing the future traffic congestion. It extends from just north of the existing Oak Creek Bridge on SR179 with a curve-linear alignment past Brewer Road, and intersects with SR89A approximately 1100 feet west of the Y-intersection. The alignment is planned such that it can extend to a potential future Forest Road extension, if pursued, providing a bypass access route to the Uptown area.

Two through lanes in each direction (SR89A) are proposed, and new signalized intersections along Ranger Road at SR179 and SR89A would be required to accommodate the forecasted volumes. It is proposed to be 4 lanes, two in each direction, with raised median. Lane widths are 12 feet. A 3-foot-wide bike lane and a 5-foot-wide sidewalk would be provided on each side of the roadway. The sidewalks would be separated by a landscaped parkway of varying width.

The intersections would utilize raised channelization to restrict undesired movements and maximize traffic operations. The proposed intersection at Ranger Road and SR179 would be a 4-leg intersection (Portal Lane would be realigned to create the fourth leg).

The Ranger Road Extension requires roughly 5 acres of Right-of-Way, involving private and National Forest land. As such, early development of Right-of-Way plans is needed to proceed with the land acquisition process.

With the possible exception of some utility relocations or other preparatory work, the bypass roadway should be constructed as one project. Although multiple construction projects may be better suited for City funding, no significant incremental benefit would be realized. A single construction project will minimize coordination issues, construction of temporary connections, and administration costs. A single construction contract also reduces the construction duration which tends to minimize disruption to the public.

Access Control And Traffic Calming Measures Along SR89A and SR179

The operational efficiency of SR89A and SR179 through the City of Sedona has been bogged down by the increased traffic and turning movements to and from properties fronting the two main corridors. Limiting access to these properties through shared driveways, and raised medians results in fewer turning conflicts and improved operation. Along SR179 and SR89A, 12-foot wide raised medians are recommended in concert with combined access drives as well as the addition of certain signalized intersections. Specific recommendations for placement of raised medians and shared access drives is provided in Technical Memorandum No. 4.

It is desirable (but not necessary) that the installation of raised medians progress consecutively from one end of SR89A to the other. This would be consistent with driver expectation during and after construction, resulting in an overall safer roadway operation. The construction of raised medians, should also be coordinated with the improvements to the driveways and onsite access. This may be dependent on negotiations between the City and the owners. Some owners may be more amenable than others. Therefore, for the purpose of providing flexibility, several projects were identified along SR89A.

The duration for constructing the raised medians and access drives is dependent on when adjacent property owners come to agreement for having a combined access and how extensive the work is. An IGA (Inter-Governmental Agreement) will also be necessary with ADOT. The state may require that work be done within a specified timeframe or that it be programmed with a pavement improvement project along the corridor. Coordination with public and other agencies will undoubtedly take additional time and effort to execute.

Access Control in the Uptown Area

For the Uptown Area, signals, parking facilities, medians, and transit are all proposed. These improvements, however should be considered together since they are interdependent in providing effective traffic operations. With respect to parking facilities, it is recommended that the City pursue options for providing additional public parking adjacent to or close by the business area. Discussions with business owners should shift gears with respect to developing a plan for parking in the Uptown Area. A parking study is also recommended to identify an overall plan for public parking in the Uptown Area. It would determine how much public parking would be needed (and when), identify where additional public parking facilities should be located, address how transit plays into the overall plan, and layout traffic circulation patterns to optimize traffic flow along SR89A and major local streets. An economic evaluation of real-estate and parking facilities (pavements, structures, etc.) would also be included so that project costs can be determined and programmed.

It is also recommended that raised medians be placed in the Uptown Area to control U-turns, left turn movements (into parking), and to provide additional protection for pedestrians. A 16-foot wide raised median should be placed between Forest Road and Apple Avenue. A 8-foot wide (minimum) median from Forest Road to Jordan Road should be considered due to the length of the left-turn bay at Jordan and the roadway width of SR89A at that location. Medians north of Apple Avenue should be evaluated as part of the roadway improvements and signalization in conjunction with the Cliffs development project.

Medians in the Uptown Area should be constructed in conjunction with the proposed signalization work (see discussion below). Improvements north of Apple Road should be postponed until the Cliffs project is further advanced. No review has been done of the utilities in the Uptown Area and how they may be impacted by construction of raised medians. However, little or no utilities are expected in SR89A (other than street crossings), and that drainage would not be a major concern.

Pedestrian Crossing Locations in the Uptown Area

It is recommended that signals be placed at the Forest Road intersection, the Mid-block location, and at Cliffs Drive. Forest Road is approximately 740 feet from the mid-block crosswalk, which in turn, is 1,080 feet from Cliffs Drive.

Signals in the Uptown Area can be implemented in phases, however, it is more desirable for the Forest Rd. and Mid-block pedestrian signals to be constructed as one project along with the raised median, since the median has a significant impact on the operation of the signals. For the Mid-block pedestrian crossing, raised medians should be constructed from Apple Avenue to approximately 50 feet south of the mid-block crossing. This is recommended to keep vehicles from making U-turns at mid-block. However, this suggests that a plan for additional parking off of SR89A be ready for implementation so that drivers will be less inclined to make U-turns at Apple Ave.

The Forest Road signal has already met warrants for signalization, and could be constructed now to improve the flow of traffic entering the Uptown Area from the south. Additional costs associated with the intersection improvements are necessary, and therefore, should be considered in conjunction with other Uptown Area improvements (i.e., parking, raised medians). Raised medians at the intersection should be constructed as part of the intersection improvements. Due to the length of medians and potential for utility work, it is recommended to construct the Forest Rd. intersection, mid-block pedestrian crossing, and raised medians (to Apple Ave.) at one time.

The Cliffs Drive signal, is dictated by the traffic demand associated with the proposed Cliffs development project. If the Cliffs project is delayed, the need for a signal there will also be delayed.

Transit Stop Locations

The proposed transit route to the Uptown Area would primarily run along SR89A and SR179. Stops along the route would be at significant retail destinations and parking facilities. It is recognized that transit is very early in the study phase, and will not likely be developed in the same timeframe as the roadway improvements. However, it is recommended that routes be established, along with criteria for amenities such as bus stop turnouts and street furniture, so that they can be accommodated when other street improvements are being made.

Thresholds for Implementation

As the Uptown Area and West Sedona develop, traffic will increase, further straining the operation of the Y-intersection. It is recommended that the Ranger Road Extension be completed by the time the Y-intersection reaches LOS F, so that traffic congestion would not occur for an extended period of time. Determination of when the Ranger Road Extension would be needed depends on the growth rate of future developments in the Uptown Area as well as West Sedona. It can happen little by little over a long period of time, or it can happen relatively quicklt by a single large development project. If it is assumed that the traffic volume at the Y-intersection increases at a rate equivalent to the overall population growth rate of 4% per year, it will reach a LOS F in roughly 4 years. If, however, the Cliffs Development project

takes place as planned, the Y-intersection could reach LOS F much sooner. In either scenario, planning for the Ranger Road Extension should begin now, allowing sufficient time for Right-of-Way acquisition, so that it will be ready for construction when needed.

Access control and calming measures along SR 89A and SR 179 (medians, etc.) can be implemented independently from the other proposed improvement projects. Ideally, these improvements should be completed by the time the state routes reach a LOS F, but could be implemented sooner to improve traffic efficiency and safety conditions. There are two aspects to these projects that affect their schedule. One is reaching agreement on shared access among the property owners, the other is programming the highway improvements with ADOT. These are likely to be a lengthy and time consuming processes. If the City chooses to implement the off-highway access improvements before programming the highway improvements, there would be less pressure on the property owners to reach agreement, and would likely take a longer period of time. Therefore, it is recommended that the City consider a program to begin discussions among property owners and implementing certain projects where feasible. Since SR 179 is expected to be reconstructed by 2010, improvements along the highway should be implemented as part of the reconstruction.

Implementation of access control measures in the Uptown Area depends upon a couple of issues. First, an overall plan needs to be developed which should address parking needs in the area. It is understood that the Main Street program will pusue uptown parking issues and a plan may be prepared in the near future. Second, it would be desirable to construct all street improvements at one time. These include medians, signals, and street scapes for directing pedestrian traffic toward designated crossings. Not do they work together toward improving pedestrian/vehicle traffic, but it would minimize the period of disruption in the area. Since there already are warrants for signalizing the Forest Road intersection and mid-block pedestrian crossing, the City should consider implementation of the SR 89A improvements as soon as the parking plan is completed.

Planning and public support needs to occur before transit stops can be designed or constructed. Issues to be resolved include, number of buses or trolleys, route determination, funding, and operation and maintenance. It is recommended that the City consider initiating a planning effort to make some determination regarding locations of transit stops for future considerations.

Evaluation Process

This section presents a discussion of the process used to evaluate and prioritize the recommended corridor improvements. In general, a cost-to-benefit ratio was determined for each of the projects, and used to prioritize them for implementation. The cost-to-benefit ratio is determined by dividing the concept level construction cost by a 'benefit factor'.

The costs for each of the projects are presented in Appendix A. Unit cost data was determined using a number of sources including, 1995 Construction Costs (Arizona Department of Transportation), 1995 Marshall & Swift estimating guides, the 1993 Sweets estimating guides, and CH2M HILL's construction cost data base. Cost information from these data bases were then adjusted to reflect current costs expected in the Sedona area.

The projects were evaluated with respect to the benefits received by the public. This is done by assigning a weighted value to each of the evaluation factors. The following describes the factors considered along with the rating scale used:

1. ***Prerequisite projects.*** Certain projects require that other work be completed in advance of the project. This includes phases of work such as design work or land acquisition, as well as practical sequencing of construction such as total intersection improvements (medians and signals). The factor is used as a basis for sequencing the projects and not for rating their benefit.

2. Improvements to ***traffic*** is one of the most significant impacts when evaluating the recommended improvements, since it is the base objective in making changes to the present system. Traffic improvements is measured in terms LOS and future traffic volumes where possible. However, in some cases, the impacts to the recommended improvements is not clearly quantifiable, such as improvements resulting from a section of raised medians.

   RATING:

   1 - Negative impact. May result in project delays, additional costs, liabilities, etc.

   2 - No discernible improvement to traffic identified.

   3 - Some improvement to traffic congestion (indirect and/or long term).

   4 - Immediate and long term traffic improvements are realized. Likely to improve LOS classification.

   5 - Definite traffic improvement. Improves LOS.

3. *Safety* is a primary objective to improving the existing traffic conditions. How well the improvement projects do to reduce the potential for accidents, however, is somewhat subjective. Improvements intended to reduce the potential for vehicle/pedestrian conflict were given a higher value, since they are more likely to involve personal injury. Improvements intended primarily to relieve congestion were given a lower value.

   RATING:

   1 - Negative impact. May result in additional liabilities.

   2 - No discernible improvement to safety conditions.

   3 - Some indirect and/or long term safety conditions are identified.

   4 - A reduction in accident potential is likely.

   5 - Definite/significant reduction in accidents is expected.

4. *Right-of-Way* needs are defined for each of the recommended improvements. Projects that do not require acquisition of Right-of-Way, are ranked highest.

   RATING:

   1 - Negative impact. Additional Right-of-Way is immanent, resulting in additional costs and introducing potential for schedule delays.

   2 - Right-of-Way needs are minimal with reasonable negotiation potential. Examples: minor widening, minor takes for intersection improvements, drainage easements, and temporary construction easements (TCE).

   3 - Potential for minor Right-of-Way takes is possible (possible utility easements needed).

   4 - No additional permanent Right-of-Way is expected (possible TCEs).

5 - Work will be done completely within existing road Right-of-Way.

5. Physical and developmental ***constraints*** consider factors associated with private interests. Physical constraints include such things as material shortages, requirements for retaining walls, and utility relocations. Developmental constraints consider such things as development of other planned improvements. For example, construction of the traffic intersection at Cliffs Drive is very much dependent on when (and to what extent) the Cliffs project gets developed. Likewise, the construction of raised medians in certain areas depends on the collaboration of several owners to combine their parking facilities.

   RATING:

   1 - Negative impact. Can not be constructed without extensive improvements by others.

   2 - Other potential projects need to be considered/planned. Significant Negotiations is expected.

   3 - Potential conflicts with other projects is minimal. Negotiations with owners is expected, but would not cause undue costs or delays.

   4 - No conflicts or opposition are anticipated.

   5 - Project will lead to other projects done more effectively. Public support is immediate.

6. ***Environmental*** considerations become a factor if the project is outside of existing road Right-of-Way (e.g., Ranger Road Extension), or if there is an effect on the air quality, noise levels, or lighting levels in the immediate area.

   RATING:

   1 - Negative impact. Potential for conflict with natural habitats. Likely to cause impact on air, noise, or lighting.

   2 - Likely to impact existing air, noise, lighting levels; mitigation measures need to be determined.

   3 - Impact to air quality, noise levels and/or lighting levels is minimal. Special mitigation measures would probably not be required.

   4 - No changes to environmental considerations are identified.

   5 - Potential net improvements to the environment can be identified.

7. Anticipated ***timeframes*** will influence a project with respect to when it can reasonably be scheduled. This factor considers 'how long it will take' and does not consider for the interdependency of other projects (factor number 1 above). Projects that require Right-of-Way or further study (such as transit) can not be expected to be completed in the same timeframe as projects ready to be designed.

   RATING:

   1 - Further study is necessary before project can be reasonably identified and programmed.

   2 - Project schedule is linked to completion of other work (but not dependent on other work).

   3 - Project requires approval processes/ agency agreements; potential for project delay.

   4 - Potential for project delays exist.

5 - Project can be implemented immediately.

8. Agency *agreements* (joint funding, approvals, etc.) have bearing on the priority of projects. Preparation of agency agreements, can take some time which may drive the preference of one project over that of another.

   RATING:

   1 - Project requires multi-agency/entity agreements; high potential for project delay.

   2 - Project requires agreements between City and other parties that may impact schedule/cost share.

   3 - Project requires agency approvals that may impact schedule.

   4 - Standard agency approvals needed.

   5 - No approvals or agreements needed.

Figure 1 shows how each of the above factors were applied to the component projects. The projects were first sequenced based on what prerequisite work needs to be completed before a particular project can begin. A rating was then assigned to factors 2 through 8 above based on whether the factor results in a positive (high value) or negative (low value) impact on the project. Factors 2 and 3 were considered twice as important as factors 4 and 5, which in turn, were considered twice as important as factors 6, 7, or 8. This is an arbitrary weighting, but is somewhat analogous to quality, cost, and schedule. The total score for each project was then used in the denominator in the cost-to-benefit ratio.

Figure 2 presents the cost-to-benefit ratio and prioritization of projects. A lower cost-to-benefit ratio means greater value at less cost, and is more desirable than a higher ratio. It is used to determine which projects should be considered first for earliest completion (so that benefits are realized). The Cost-to-benefit ratio is determined by dividing the project cost by the evaluation factor, as well as a *use factor* and a *needs factor*.

There are two basic types of improvement projects; existing street improvements and new corridors. The benefits received from new corridor improvements (e.g., Ranger Road extension) are substantially greater than the benefits received from a street improvement in terms of the number of vehicles affected, safety conditions, and time saved by drivers. Therefore, a *use factor* was applied to the benefits rating so that the projects can be compared on an equivalent scale.

USE FACTORS

1 - Used for street improvement projects.

10 - Used for new corridor improvement projects. These projects offer benefits to twice the number of vehicles (order of magnitude variation).

The needs factor is applied to the cost-to-benefit ratio representing the overall importance of the projects and need for the improvement to maintain an acceptable quality of transportation within the community. It is a function of the evaluation factors and is used to amplify their relative significance.

Figure 1 - Evaluation of Improvement Projects

Improvement Project	Evaluation Factor							
	Traffic x4	*Safety* x4	*Right-of-Way* x2	*Constraints* X2	*Environmental* x1	*Timeframes* x1	*Agreements* x1	**TOTAL**
Forest Rd./ Mid-block Signals	5 x 4 = 20	5 x 4 = 20	3 x 2 = 6	4 x 2 = 8	3	5	4	**66**
Ranger Road	5 x 4 = 20	5 x 4 = 20	1 x 2 = 2	4 x 2 = 8	2	3	1	**56**
Uptown Medians	4 x 4 = 16	4 x 4 = 16	5 x 2 = 10	2 x 2 = 4	3	2	2	**53**
Cliffs Rd. Signals	4 x 4 = 16	3 x 4 = 12	3 x 2 = 6	1 x 2 = 2	3	2	2	**43**
West Sedona Raised Medians								
Canyon/ Schnebly Hill	3 x 4 = 12	3 x 4 = 12	2 x 2 = 4	3 x 2 = 6	4	2	3	**43**
Dry Creek/ Roadrunner	3 x 4 = 12	3 x 4 = 12	1 x 2 = 2	3 x 2 = 6	4	4	3	**43**
Roadrunner/ Southwest	3 x 4 = 12	3 x 4 = 12	1 x 2 = 2	2 x 2 = 4	4	3	2	**39**
Southwest/ Madole	3 x 4 = 12	3 x 4 = 12	2 x 2 = 4	1 x 2 = 2	4	3	2	**39**
Madole/ Payne	3 x 4 = 12	3 x 4 = 12	1 x 2 = 2	2 x 2 = 4	4	3	2	**39**
Willow/ Airport	2 x 4 = 8	3 x 4 = 12	2 x 2 = 4	3 x 2 = 6	4	2	3	**39**
Payne/ Willow	3 x 4 = 12	3 x 4 = 12	1 x 2 = 2	1 x 2 = 2	4	2	3	**37**
Transit Stops	3 x 4 = 12	2 x 4 = 8	2 x 2 = 4	1 x 2 = 2	5	1	4	**36**

Figure 2 - Cost-To-Benefit Ratio

Improvement Project	a Concept Level Project Cost	b Evaluation Factor	c Normalizing Factor	d Needs Factor	(a/bcd) Cost-to-Benefit Ratio
Forest Rd./ Mid-block Signals	$ 218,900	66	1	2	**1658**
Uptown Medians	$ 180,800	53	1	2	**1706**
Ranger Road	$ 3,822,600	56	10	3	**2275**
Cliffs Rd. Signals	$ 125,100	43	1	1	**2909**
West Sedona Raised Medians					
Willow/ Airport	$ 125,000	39	1	1	**3205**
Roadrunner/ Southwest	$ 128,500	39	1	1	**3295**
Canyon/ Schnebly Hill	$ 170,000	43	1	1	**3953**
Dry Creek/ Roadrunner	$ 240,700	43	1	1	**5598**
Madole/ Payne	$ 262,000	39	1	1	**6718**
Transit Stops	$ 281,500	35	1	1	**8043**
Southwest/ Madole	$ 316,300	39	1	1	**8110**
Payne/ Willow	$ 348,200	37	1	1	**9411**

NEEDS FACTORS

1 - Project has clear benefit, and is considered important to the community's transportation needs.
2 - Project is very much needed and will make a significant improve to the community's transportation system.
3 - Project is critical to the community's transportation system. Without it would severely impact the community's economic health.

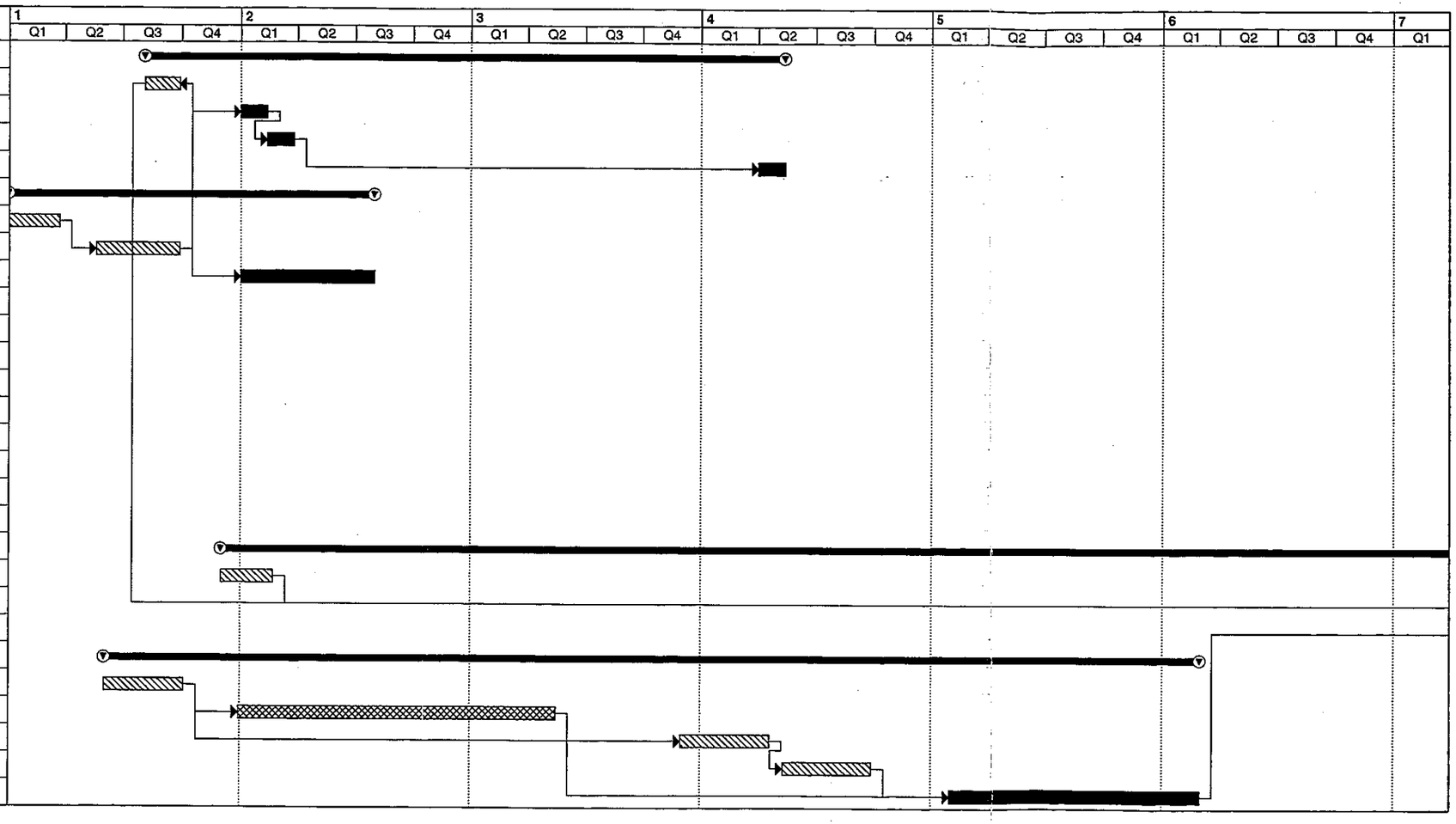
Implementation Schedule

From the cost-to-benefit ranking, a program schedule was prepared and presented in *Figure 3*. Consideration is given to availability of funds, as well as time needed for negotiating interagency agreements for joint participation. However, project funding dictates the implementation schedule far more than any other factor. For the purpose of developing the schedule, it was assumed that the City would fund 100% of the projects at an annual rate of approximately $250,000. The exception to this is the Ranger Road Extension project. Because of its cost, a combination of funding sources needs to be considered, including participation by ADOT, City bonding, and development impact fees. It is assumed that the City would fund approximately 25% of the project.

Based on the above assumptions, the schedule shows that the Uptown improvements could be constructed within the next 2 to 3 years, and the Ranger Road Extension could be constructed within 5 to 6 years. These timeframes are consistent with when they would be needed. Roadway improvements along SR89A in West Sedona could take as long as 11 years to construct, and transit facilities could take as long as 13 years. These projects, however, could be advanced if other funding sources were made available.

Highway Corridor Improvements - Implementation Schedule
Years

ID	Task Name
1	**Traffic Signals - Uptown**
2	Design
3	Uptown Mall (Mid-block)
4	Forest Road Intersection
5	Cliffs Drive Intersection
6	**Access Control - Uptown**
7	Parking Study
8	Design (Medians & Roadside Improvements)
9	Construction - Forest/Apple
10	**Access Control/Signals - SR179 & SR89A**
11	Design
12	Construction - Willow/Airport
13	Construction - Roadrunner/Southwest
14	Construction - Canyon/Schnebly Hill
15	Construction - Dry Creek/Roadrunner (w/ Dry Creek Signal)
16	Construction - Madole/Payne
17	Construction - Southwest/Madole (w/ Andante Signal)
18	Construction - Payne/Willow (w/ Posse Ground Signal)
19	**Transit Stop Locations**
20	Transit Study
21	Design
22	Construction
23	**Ranger Road Extension**
24	Initial Design
25	R/W Acquisition
26	Preliminary Design
27	Final Design
28	Construction (w/ Ranger Road Signal)



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Highway Corridor Improvements - Implementation Schedule
Years

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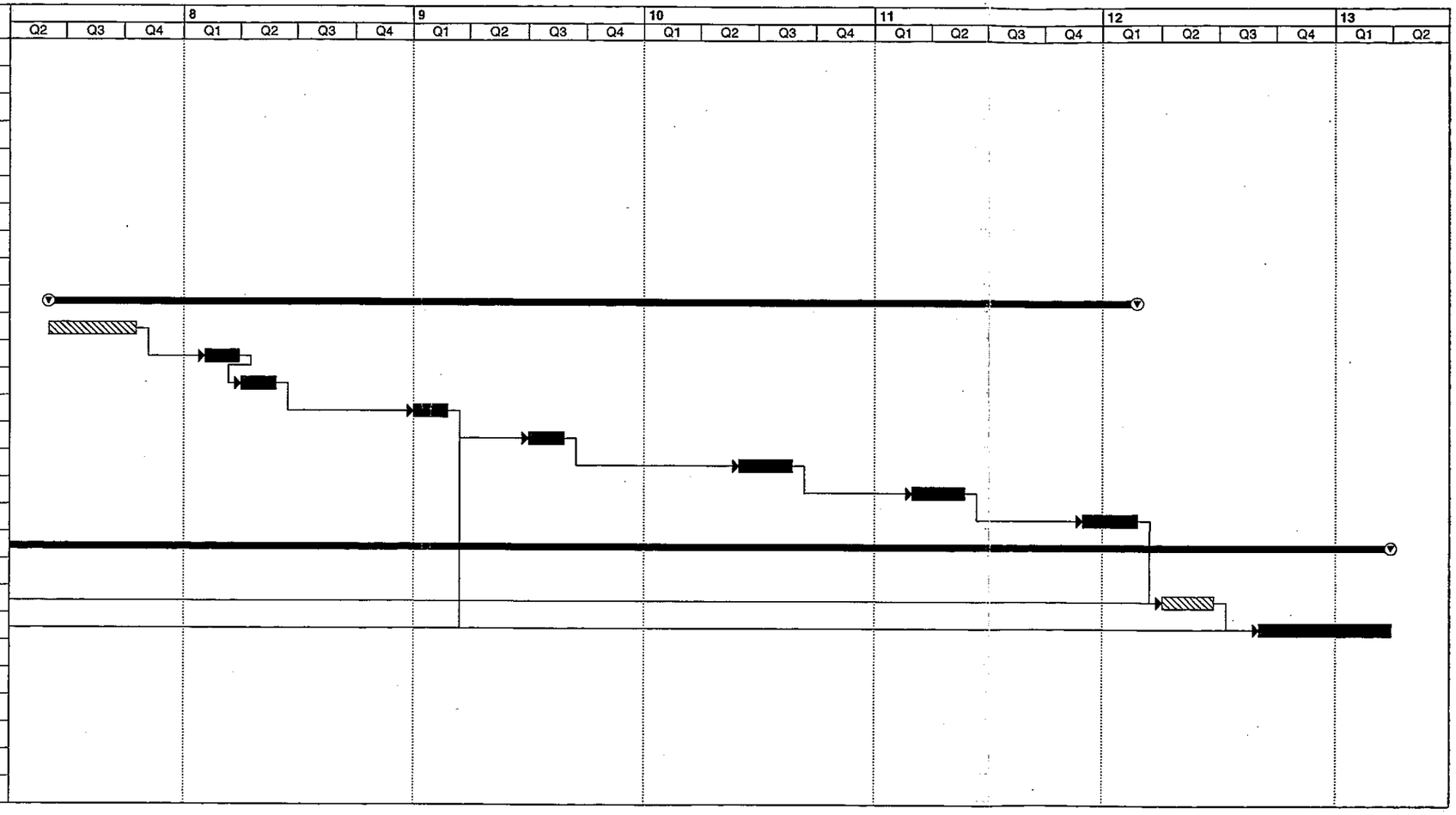

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Conclusions / Recommendations

Together, the circulation improvements recommended in Technical Memorandum Nos. 3 and 4 will substantially contribute to improving the efficiency and calming of traffic along SR89A and SR179. Prioritizing these recommendations, however, allows for a logical approach toward programming and implementing the projects. Projects that offer the most benefit for the least cost are identified and can be scheduled for implementation.

The signals and medians in the Uptown Area offer the greatest benefits for their cost. Although it is recommended that they be implemented together and in conjunction with a parking study, they could be constructed independently. The Cliffs Rd. signal has a low calculated ratio, but is hinged on when the Cliffs project is developed. Once the Cliffs Development project is in place, the Cliffs Rd. signal will be needed.

The Ranger Road extension offers a substantial improvement to the present and future traffic conditions, but its cost is proportionately higher than other proposed improvements. It will take considerably more time to plan, acquire needed Right-of-Way, design, and construct than other projects. Planning should begin now by initiating discussions with ADOT regarding joint funding, Right-of-Way needs, environmental concerns, and process development considerations (i.e. Design Concept Study needed? public involvement requirements?).

A range of cost-to-benefit ratios were calculated for the West Sedona Raised Medians and traffic calming schemes. Since they will be tied to schedules driven by ADOT's pavement programs and negotiations with private entities, they will likely take the greatest amount of time to implement. However, it is recommended that a program be initiated within the City to begin discussions with owners along the highway corridors, so that the improvements may be programmed when funding becomes available.

Development of transit stops has one of the higher cost-to-benefit ratios simply because of the little effect it is expected to have on improving the traffic or safety conditions. The issue of transit in Sedona, however, deserves further study, and should be done in connection to a public parking plan. This means that transit is probably some time away, and is a lower priority than many of the other projects.